

RESEARCH ARTICLE

SERUM CHEMISTRY ABNORMALITIES IN CHILDREN WITH UNPROVOKED SEIZURES

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Abstract:

Objective

Most children brought to the emergency department (ED) for evaluation of seizures undergo an extensive laboratory workup. Since results are usually negative, the value of such routine laboratory workups has been questioned. A group of children with unprovoked seizures was prospectively studied to determine the diagnostic values of routine serum chemistries and to identify risk factors predictive of abnormal findings.

Materials & Methods

All patients evaluated at the ED of the Ghaem hospital during a consecutive 12 months period between Jan 2004 through Jan 2005 were studied. We collected data for patient's demographics, details of the history of present illness (including vomiting, diarrhea, apnea), medication use, past history of seizures, family history of seizures, metabolic disorders or other chronic medical illnesses, neonatal history and neurological examination as well as nutritional status, type and time of seizure. The role of abnormal serum chemistries as a seizure trigger factor was assessed in patients with a history of seizure.

Results

A total of 210 patients (mean age 19.2 months) with unprovoked seizures were evaluated. Twenty-three serum abnormalities were noted in the patients (12 cases of hyponatremia, 7 of hypoglycemia, 4 of hypokalemia, 4 of uremia). The incidence of abnormal serum biochemical values was higher in patients with a first seizure, younger patients, and those with gastrointestinal symptoms.

Conclusion

According to the present study, one can conclude that in children younger than 2 years and having no structural CNS abnormality, electrolyte and glucose screening is recommended only for a first unprovoked seizure, when gastrointestinal symptoms or symptoms suggesting electrolyte disturbances are present.

Keywords: Unprovoked, Seizure, Biochemistry, Children

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Introduction

Seizures are one of the most common causes of admission in pediatric Emergency Departments (ED). Evaluation of seizures in children usually needs expensive laboratory workups, results of which are usually normal in these groups. Investigators have found that among older children presenting to an ED with both febrile and non-febrile seizure, no child had a serum chemistry abnormality necessitating a change in patient care (1). Among children aged 1 through 7 years, presenting to an ED with seizure, none of the 71 tested children had a clinically significant abnormality (2). In one series, 7 of 12 children less than 2 years of age presenting with a non-febrile seizure were found to have serum sodium levels below 127 meq/L (3). In a larger series, 70% of 47 infants with seizures were found to be hyponatremic (4). These controversies in studies have led to the value of routine laboratory workups being questioned. In this prospective study we selected a group of children with unprovoked seizures selected to determine the diagnostic values of routine serum chemistries and to identify risk factors predictive of abnormal findings.

Materials & Methods

Patients with seizures, aged between one month and 14 years, presenting to the Pediatric Emergency Department (ED) of Ghaem Hospital of Mashad University between Jan. 2004 and Jan. 2005 were enrolled in the study. We excluded infants with seizure disorders who were in the ED for reasons other than seizures, as well as those with head trauma immediately preceding seizure onset or intracranial shunts, febrile seizure, brain tumor and children with a provoked seizure. Data was collected for patient demographics, details of the history of present illness (including vomiting, diarrhea, apnea), medication use, past history of seizures, family history of seizure, metabolic disorders or other chronic medical illnesses, neonatal history and neurological examination as well as nutritional status, type and time of seizure. Ranges for normal serum electrolytes, sodium, potassium, glucose, total calcium, magnesium, urea, creatinine and phosphorous; values were defined based on Nelson's Textbook of Pediatrics (5). Clinically significant serum chemistry abnormalities were those falling outside of the normal range and resulting in either a direct alteration of patient management. Patients divided in two groups,

those who had abnormal biochemical values and those with normal laboratory data.

We used the student t-test to compare means in quantitative values and chi-square to compare proportion of characteristics. Statistical analysis was performed using SPSS version 11 statistical software and P value less than 0.05 considered significant. The study was approved by the proposal committee of the Mashad faculty of medical sciences.

Results

A total of 210 patients with unprovoked seizures were enrolled in this study and laboratory studies were done for all patients; mean of age was 19.2 ± 23.5 months; one hundred and nineteen (56.7%) were female and 91 (43.3%) were male. One hundred and sixty seven (79.6%) patients, had history of at least one seizure and 43 (20.4%) had no history of previous seizure. Among the study cases, 187 had generalized tonic clonic seizures, 13 myoclonic and 10 simple partial seizures. The patient characteristics on admission to the ED are shown in Table 1.

Twenty-three (10.9%) patients had abnormal serum biochemical values, revealing 28 serum abnormalities. We detected 12 cases of hyponatremia and 7 cases of hypoglycemia. Table 2 displays the frequency of abnormal serum chemistries for cases. Ninety-two percent (21 out of 23) of patients had generalized tonic clonic seizures and only two out of 23 had simple partial seizures. Mean age of the abnormal serum biochemical group compared to the group with normal values (mean of 11.3 ± 5.8 months vs. 27.1 ± 13.3, respectively) was statistically different (student t-test, p value = 0.004).

A significant difference was seen in onset of first seizures in patients with or without metabolic abnormalities (12/23 vs. 31/187, p<0.05, chi-square). Patients with abnormal chemistries presented more frequently with vomiting and diarrhea compared to normal ones. (47.8% vs. 12.8%, p<0.05, chi-square). Comparison of data between group of abnormal biochemical values and normal group has been shown in table 3.

Table 1. Patient characteristics at admission

Patient characteristics		Number (%)
Gender	Male	91(43.3)
	Female	119(56.7)
First seizure		43(20.4)
Positive Family history		23(11)
Vaginal delivery		64(30.5)
Breast fed		139(66.3)
Underlying neurological disease		32(15.2)
Status epilepticus		16(7.6)

Table 2. Results of serum chemistry abnormalities in patients with unprovoked seizures

	Hyponatremia	Hypoglycemia	Hypokalemia	Uremia*	Hypercalcemia
No.	12	7	4	4	1
Percent	42.8	25	14.2	14.2	3

* Increased urea nitrogen or creatinine

Table 3. Patient characteristics of the normal and abnormal serum chemistry groups

Patient characteristics	Normal	Abnormal	P value
Gender(Male)	58%	45%	0.7
First Seizure	16%	52%	<0.05
Breast Fed	68.7%	63.7%	0.62
Gastrointestinal Symptoms	12.8%	47.8%	<0.05
Family History	12%	9%	0.62
Vaginal Delivery	33%	28%	0.24
Neurologic Deficit	18.9%	11.5%	0.37
Abnormal CT Scan	34.5%	3.4%	<0.05
GTCS	72.6%	92%	0.8
Status Epilepticus	13.2%	2%	0.7

According to table 3, frequency of abnormal serum biochemical values were higher in those with a first seizure, normal brain CT scan or those with gastrointestinal symptoms.

Discussion

Laboratory workups of children admitted to ED for unprovoked seizures are costly and in most countries are negative. The American College of Emergency Physicians (ACEP) developed a clinical policy for the initial approach to patients presenting with seizures to the ED (6). This policy was intended for children older than 6 years who presented with seizures but not for those with status epilepticus. Routine electrolyte evaluation was viewed as of uncertain value and not required for patients whose mental status and physical examination were normal. The Working Group on Status Epilepticus recommended that serum chemistries should be obtained for adults and children with status epilepticus (7).

In six studies involving 202 children, abnormalities in glucose (3 patients), calcium (5 patients), and sodium (7 patients) were detected. Most abnormal sodium and calcium levels were observed in children under two years old, and half were suspected by history (8). Thus, questions have been raised as to the usefulness and cost-effectiveness of such tests in the evaluation and treatment

of patients presenting to the ED with seizures (9). There have been several studies determining the usefulness of routine laboratory tests in children presenting with seizures to the ED, but most of them are retrospective and have focused on patients presenting with febrile seizures; these studies recommended electrolyte testing if clinically indicated, and lumbar puncture in first febrile seizures (10, 11, 12, and 13). In the Jaffe et al study, 562 children presenting with their first febrile seizure were tested for electrolytes, calcium, and glucose (12); just 9 (2%) significant abnormalities were found and all but 2 of these were clinically suspected. Nypaver et al in 1992, in a retrospective study conducted on 308 children (65% non-febrile) showed derangements of serum sodium, potassium, and glucose in unprovoked seizure. They reported that no abnormal test was thought to have caused the seizures and concluded that routine serum tests were not necessary in children older than 3 months with uncomplicated seizures, unless an abnormality was suspected clinically based on history or physical examination. In their report, serum biochemistry tests were done in 40% of cases (1). Kenney, also in a similar retrospective study reported 241 children with both febrile and non-febrile seizures, and had no abnormal serum biochemical values. They recommended electrolyte testing only if clinically indicated; in their study just

64% of cases had biochemical data (14). Scarfone in 2000, in a retrospective cohort of 134 children with both febrile and non-febrile seizures (half of which had biochemistry data) detected 13% abnormal serum biochemistry values (hyponatremia and hypocalcemia)(15). Their results supported the recommendation of testing patients younger than 1 month, with low temperature or with active seizures; one of the study limitations is that all these researchers worked on both febrile and non-febrile seizures.

Valencia and co workers prospectively evaluated 107 children with unprovoked seizures and found a total of 8 metabolic abnormalities in 7 children (13%). In 3 of these, the abnormality was thought to be the cause of the seizure (2 cases with hyponatremia and one with hypoglycemia). The risk factors in their report associated with metabolic abnormalities in this group of patients were first seizure, younger age, gastrointestinal disturbance (vomiting or diarrhea) and change in mental status. None of the children with sub therapeutic anticonvulsant concentrations had significant electrolyte disturbances. They concluded that when not clinically indicated, laboratory test results typically are normal and of no benefit in the diagnosis and treatment of children presenting with unprovoked seizures to the ED. In their study just 49% of cases had laboratory investigations (16).

The present study is a prospective observational analysis of 210 children who came to the ED with unprovoked seizures. We found a total of 28 metabolic abnormalities in 23 children (10.9%), in 19 of which the abnormality was thought to be the cause of the seizure (12 cases with hyponatremia and 7 with hypoglycemia). In agreement with the Valencia et al study, the risk factors that were associated with metabolic abnormalities in our patients were first seizure, younger age, gastrointestinal disturbance (vomiting or diarrhea). Our study confirmed that above the age of 2 years, laboratory workup is routinely recommended.

There were some study limitations. We did not measure serum levels of anti epileptic drugs in patients. Also as a tertiary care referral center, we may most probably have seen a sicker subset of children, leading to an overestimate of the frequency of laboratory abnormalities among a more general population.

Conclusion

According to the results, one can conclude that the electrolyte and glucose screening is recommended only for a first unprovoked seizure, when gastrointestinal symptoms or symptoms suggesting electrolyte disturbances are present, in children younger than 2 years and with no structural CNS abnormality.

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