

*Full Length Research Paper*

# Are laboratory workup really needed on management of pediatric seizures at emergency rooms?

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**This study was carried out to determine the value of workup done at emergency departments (EDs) on the management of pediatric seizures. We retrospectively reviewed all patients with seizures admitted to Ege University's Childrens Hospital's ED between March and December 2008. All demographic findings, seizure characteristics and laboratory workup were recorded. Eighty-three children were eligible. The mean age was 5.5±4.6 years; majority seizures (83%) lasted less than 10 minutes of which 66% were afebrile. Although, most patients had blood workup (92%), cranial computerized tomography scan or electroencephalogram was carried out in only five patients. Metabolic abnormalities were detected in 25 patients. The frequency of metabolic abnormalities was significantly higher in patients under two years of age (53.4% vs 24.4%) (p=0.02). No seizures occurred due to metabolic abnormalities. CT scans and EEG were abnormal in a patient with tuberous sclerosis. Six patients were hospitalized. Although, blood workup, CT scans and EEGs are frequently obtained in patients with seizures at EDs, they have a limited value on management. Our results showed that extensive workup may be helpful in selected patients, i.e those younger than two years of age, that have either focal seizures or seizures lasting longer than 10 minutes.**

**Keywords:** Seizure, children, workup, emergency department.

## INTRODUCTION

Seizures are frequently seen in childhood, some of which may be life-threatening. Neurologic emergencies make up 25% of all pediatric code calls (Isaacman, 2003). The majority of children presented with seizures to the emergency departments (EDs) are often evaluated after extensive laboratory workup including routine CBC, serum biochemical analysis (glucose, electrolytes, etc) as well as CT scans. However, several studies have reported that these laboratory test results conformed to norms in most patients and do not effect the management of patients with seizure at ED. These reports were conducted on patients with a first, unprovoked afebrile seizure or known epilepsy (Eisner, 1986; Maytal et al., 2000; Wolf, 1978; Krumholz et al., 1989; Pellegrino, 1994) and patients with febrile seizures (Wears et al., 1986; Rutter and Smales, 1977; Jaffe et al., 1981).

To our knowledge, there is no existing data in our

country on this topic. As a tertiary healthcare facility, we observed in our ED most physicians in Turkey prefer to obtain extensive laboratory workup besides CT scans regardless of the type of seizure.

In this retrospective study, we aimed to determine the role of routine CBC, serum biochemical analysis, CT scans and EEGs in the management of children with seizures in EDs and to identify the factors required for extensive workup.

## PATIENTS AND METHODS

The patients included in this retrospective study were seen at Ege University's Childrens Hospital's ED between March – December 2008. All children aged 3 months -17 years with seizures were included in the study. Data was collected by reviewing the ED charts. Information regarding patients' demographic findings such as age, gender and chief complaints were recorded. Specific information about seizures included, types of seizure, duration and the presence of fever. Charts were also reviewed for ordered diagnostic tests such as CBC,

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**Table 2.** Characteristics and demographics of patients with seizure.

Seizure characteristics	<5 years n=52	>5 years n=31	Total n=83
> 10 min	8 (9,6%)	6 (7,2%)	14 (16,8%)
< 10 min	44 (80,4%)	5 (92,8%)	69(83,2%)
Febrile	26 (50%)	2 (6,5%)	28(33,7%)
Afebrile	26 (50%)	29 (93,5%)	55(66,3%)

serum electrolytes, CT scans or EEGs and patient management. Children were classified into two groups; those having febrile seizures (FS) or afebrile seizures (AFS). Febrile seizures of focal nature or lasting longer than 15 minutes or recurred seizures within 24 hours were accepted as complicated febrile seizures.

To identify the association of seizure and age related metabolic abnormalities, all patients were classified into three groups; Group 1: patients aged under two years, group 2: patients aged between 2-5 years, group 3: patients aged more than five years.

According to our clinical biochemistry laboratory, normal ranges for serum electrolytes were as follows: serum sodium (Na): 136 – 145 meq/l, potassium (K): 3.5 – 5 meq/l, Glucose: 60-110 mg/dl. Hyponatremia and hypokalemia were described as being less than 136meq/l, and 3.5meq/l respectively. Serum glucose levels higher than 140mg/dl were accepted as hyperglycemia.

One-way ANOVA was used to compare the means of numerical groups. The proportion of clinical characteristics in patients with normal or abnormal workup was compared using the Chi-square test. Differences were considered significant at a  $p < 0.05$ .

## RESULTS

Eighty-three patients with seizures were admitted to ED during the study period. The mean age of the group was  $5.5 \pm 4.6$  years, with a range from 0.25 to 17 years. Fifty patients were male and thirty-three were female. AFS were seen in 55 patients (66%). FS was found in almost half of the patients aged less than five years. Apart from two of the thirty-one patients (6.4%), all of the patients were five years or older and had AFSs. Most of the described seizures' (83.2%) durations were shorter than 10 minutes. In both age groups (younger than 5 years and older than 5 years) the rate of seizures shorter than 10 minutes, was 80.4% and 92.8% respectively (Table 1).

Most patients (92%) had workup for CBC. Serum electrolytes/ glucose and CRP were studied in 85 % and 26% of patients respectively.

Thirty-one metabolic abnormalities were detected in 25 patients (30%). Hyponatremia was determined in 13 patients (15,6%) their levels ranged between 123- 135 meq/l with a mean value of  $133.4 (\pm 1.4)$ . Hyperglycemia was also found in 13 patients (15.6%) their levels ranged between 142-248mg/dl ( $183 \pm 31$ mg/dl).

Hypokalemia was seen in five patients (6%). Potassium levels ranged between 2-3 meq/l ( $2.8 \pm 0.4$ ). Three patients had hyponatremia in addition to hypokalemia and hyperglycemia.

The lowest Na value was 123 meq/l, it was found in a patient with cerebral palsy who had poor oral intake a week prior to admission. The lowest potassium value (2meq/l) was found in a 20 month old girl who also had hyperglycemia and hyponatremia.

For the three age groups, the rate of metabolic abnormalities were 53.8%, 37.5% and 24.4% respectively. These rates decreased by age (Table 2). However, a significant difference was found when group 1 and group 3 were compared (53.8% vs 24.4%) ( $p = 0.02$ ). Metabolic abnormalities were mostly seen in patients younger than two years. When we grouped the patients as younger or older than five years, the rate of metabolic abnormalities was 46% and 24.4% respectively and the difference between the two groups was also significant ( $p = 0.01$ ). In the FS group the frequency was 44%, in contrast to 56% in the AFS group. The difference was not significant ( $p = 0.20$ ).

CT scans were performed in only five patients (6%). One of the five patients was the youngest in our study group. She was admitted for a first, afebrile focal seizure lasting longer than 10 minutes. The patient was a three month old girl that had hypopigmented skin lesions on her trunk and hyponatremia (134meq/l). Her CT scan revealed cortical tubers and she was diagnosed as having tuberous sclerosis. Another patient with a prolonged, unprovoked, afebrile seizure had a normal CT scan. The remaining patients were known epileptic patients and they were still being followed up in the Child Neurology outpatient clinic. Their CTs were also normal.

EEGs were also obtained in five patients. They were found to be normal except in one patient with known epilepsy. He had bilateral centroparietal and occipital sharp wave activity.

## DISCUSSION

Seizure is one of the most common complaints evaluated in pediatric EDs. The frequency of seizures among both adult and pediatric populations has been reported 1-2 % of ED visits (Pallin et al., 2008; Huff et al., 2001). CBC, serum biochemical analysis and sometimes CT scans are often performed as a routine part of the diagnostic evaluation of children who arrive in the ED

**Table 2.** Distribution of metabolic abnormalities in different age groups.

	<b>Hyponatremia*</b> <b>(n)</b> <b>(min-max)</b> <b>(mean <math>\pm</math>SD)</b>	<b>Hypokalemia*</b> <b>(n)</b> <b>(min-max)</b> <b>(mean <math>\pm</math>SD)</b>	<b>Hyperglycemia*</b> <b>(n)</b> <b>(min-max)</b> <b>(mean <math>\pm</math>SD)</b>	<b>Total</b> <b>(n)</b> <b>(%)</b>
Group 1	7	1	6	14
(<2yrs)	132-135 (134 $\pm$ 1)	2	149-248 (194.5 $\pm$ 40.6)	(53.8)
n=26				
Group 2	4	1	4	9
(2-5yrs)	132-135	3	142-212	(37.5)
n= 24	(134.1 $\pm$ 1)		(164.6 $\pm$ 31.1)	
Group 3	2	3	3	8
(>5yrs)	123-135	3-3	176-204	(24.4)
n=33	(129.6 $\pm$ 6.1)	(3)	(187.3 $\pm$ 14.7)	

\*Electrolytes values were given as mEq/l, glucose values were given as mg/dl

with seizures (Rutter and Smales, 1977; Scarfone et al., 2000). As a tertiary referral center, our observational experience showed that some physicians also request BUN, creatinine, SGOT, SGPT, PT, APTT tests etc. However, in most patients these laboratory test results are usually normal and do not contribute to seizure therapy (Wolf, 1978; Krumholz et al., 1989; Pellegrino, 1994).

Both our study populations' mean age and the rate of febrile/ afebrile seizures were similar to the Nypaver et al group (Nypaver et al., 1992). Nypaver and co-workers retrospectively reviewed 308 pediatric ED charts and reported a 65% frequency of AFS (66% in our group). In most of our patients (92%) blood samples were taken for analysis, however the same ratio was 40% in the Nypaver and coworkers' group. We believe that the difference may be explained by the different approaches to pediatric seizures at EDs.

Particularly in infants and young children, seizures might have occurred due to metabolic problems such as hypoglycemia, hypocalcemia and hyponatremia. Metabolic abnormalities such as hyperglycemia, hyponatremia and hypokalemia were found in 30% of our cases. Although hyperglycemia was found in 16% of our patients, it was transient and it resolved without any treatment, so we concluded it might have been related to stress factors.

The mean sodium value in our hyponatremic patients was 132.1 $\pm$ 1.8meq/l, and the lowest value was 123meq/l. These findings imply that none of our patients had seizures due to hyponatremia. No hypoglycemic seizure was detected in the present study. However, Valencia et

al reported two hyponatremic and one hypoglycemic seizures in their study group with a mean age of 6.6 years ranging from 0.1 to 20 years (Valencia et al., 2003). This difference may be related to the different age distribution in the two studies.

Valencia et al. also combined their study with all the results of the studies of children with unprovoked seizures in the ED, and they found that the incidence of biochemical abnormalities as 8.4% (115/1361) (Valencia et al., 2003). Metabolic causes are rarely responsible for the seizures (Kenney and Taylor, 1992; Scarfone et al., 2000; Nypaver et al., 1992; Valencia et al., 2003).

There have been several studies demonstrating the pointlessness of routine laboratory tests in children with FS. These studies recommended doing serum electrolyte analysis if it is clinically indicated and lumbar puncture in a first FS (Rutter and Smales, 1977; Gerber and Berliner, 1981).

The most common cause of seizure activity in epileptic patients regardless of age is irregular usage or sudden discontinuation of antiepileptic drugs (AEDs). Although this group was not evaluated in depth in our study group, previous studies recommended checking AED levels in epileptic patients (Valencia et al., 2003).

CT scans and EEGs were obtained in few of our patients (6%), an abnormality was found in only one patient (20%). Although our sample size was not large enough to determine certain recommendations, published data was consistent with our results. Maytal et al conducted a study on 62 children with seizures who they were found to have abnormal CT findings in 14 (21.2%) (Maytal et al., 2000).

Based on our study and previous reports, we recommend a more rational use of biochemical analysis, CBC, CT scans or EEGs in children arriving with seizures to EDs. Routine examinations of CBC as well as serum biochemical values for children with seizures are unnecessary unless specific clinical data strongly suggests otherwise.

Since the metabolic abnormalities were more likely seen in children younger than two years of age in our group, it might be a rational approach to make the metabolic screening in children either younger than two years or those having gastrointestinal symptoms (vomiting, diarrhea, poor oral intake). Since the metabolic abnormalities are less frequently seen in patients older than five years, metabolic screening is usually unnecessary in this group.

Our results also showed that neuroimaging and EEGs should not be requested unless there are clinical indications. With the exception of trauma these indications were as follows: acute development of focal neurological deficits, prolonged postictal periods, a first focal seizure and changes in mental status.

At Eds, the rational requesting of laboratory tests in patients with seizures is important for both the comfort of patients and the incurred costs of examinations.

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