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Time to continuous electroencephalogram in repeated admissions to the pediatric intensive care unit

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ABSTRACT

Purpose: Describe timing from intensive care unit (ICU) admission to initiation of continuous electroencephalogram (cEEG) in repeated ICU admissions.
Method: We performed a retrospective observational study in pediatric patients who underwent repeated ICU admissions with cEEG from 2011 to 2013. The main outcome measure was time from ICU admission to cEEG.
Results: There were 41 patients (54% males) with at least 2 ICU admissions with cEEG (median (p25-p75) age at first admission: 3.3 (0.3–8.4) years, at second admission: 3.9 (1.1–9.4) years), 7 patients (57% males, 9.9 (2.9–11.5) years) with at least 3 ICU admissions, and 5 patients (60% males, 10.1 (4–10.5) years) with at least 4 ICU admissions. One patient had 21 ICU admissions. The median (p25-p75) time from ICU admission to cEEG was not different during the first and second ICU admissions [10.7 (1.9–22.9) hours versus 13 (0.2–36.7) hours; $p = 0.908$]. Among patients with electrographic seizures on first admission, time to cEEG was not different during the first and second admissions [7.9 (0.5–23.4) hours versus 14.5 (−2 to 44.5) hours; $p = 0.636$]. Among patients with status epilepticus during the first admission, time to cEEG was not different between the first and second admissions [15.3 (9–79) hours versus 40.7 (19.3–42.6) hours; $p = 0.75$].
Conclusions: The time from ICU admission to the initiation of cEEG did not decrease in second or subsequent ICU admissions, even in patients with seizures or status epilepticus on the first admission.

1. Introduction

Electrographic seizures are found in 7–46% of clinically indicated continuous electroencephalograms (cEEG) in the pediatric intensive care unit (ICU) [1–7]. The burden of electrographic seizures among critically ill children is increasingly recognized and utilization of cEEG is growing rapidly, at a pace of approximately 30% per year [8]. High electrographic seizure burden and status epilepticus (SE) are associated with poorer outcomes in neonates [9–12], children [1,5,10,11,13,14], and adults [15–17].

A growing body of research suggests that electrographic seizures may be causally related to poorer outcomes. First, prolonged electrographic seizures or electrographic SE are independently and strongly associated with poorer outcomes [5,9,14,18]. Second, seizure burden is associated with poorer neurological outcome in a dose-response pattern typical of causal associations [5]. Lastly, the time from ICU admission to cEEG is independently associated with in-hospital mortality both in neonates and older children [19]. A standardized pathway for cEEG monitoring may reduce the time from seizure onset to treatment administration [20], but little is known about the time from when a cEEG is indicated to the actual start of cEEG. A series of 625 patients showed that the time from ICU admission to cEEG initiation is prolonged −approximately 17 h− in both neonates and children [19]. While this study showed that the time to cEEG is delayed during the first ICU admission, it is currently unknown

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Table 1
Demographic and clinical characteristics. Numerical variables are presented as median (p_{25}-p_{75}). Categorical variables are presented as number and percentage.

First episode N = 41		
Age at the episode (in years)		3.33 (0.33–8.42)
Gender	Male	22 (53.7%)
	Female	19 (46.3%)
Etiology	Symptomatic structural	25 (61%)
	Symptomatic non-structural	11 (26.8%)
	Non-CNS etiology	4 (9.8%)
	Unknown	1 (2.4%)
Reason for ICU admission[a]	Seizures	15
	Status epilepticus	9
	Mental status changes	2
	Cardiac arrest	0
	Respiratory distress	9
Indication for cEEG[a]	Clinical suspicion of seizures	32
	Encephalopathy	12
	Intracranial pressure monitoring	0
	Assessment of response to treatment	1
	Other indications	5
Second episode N = 41		
Age at the episode (in years)		3.92 (1.08–9.42)
Gender	Male	22 (53.7%)
	Female	19 (46.3%)
Etiology	Symptomatic structural	23 (56.1%)
	Symptomatic non-structural	14 (34.1%)
	Non-CNS etiology	3 (7.3%)
	Unknown	1 (2.4%)
Reason for admission[a]	Seizures	18
	Status epilepticus	9
	Mental status changes	3
	Cardiac arrest	0
	Respiratory distress	11
Indication for cEEG[a]	Clinical suspicion of seizures	32
	Encephalopathy	10
	Intracranial pressure monitoring	0
	Assessment of response to treatment	2
	Other indications	4
Third episode N = 7		
Age at the episode (in years)		9.92 (2.92–11.46)
Gender	Male	4 (57.1%)
	Female	3 (42.9%)
Etiology	Symptomatic structural	4 (57.1%)
	Symptomatic non-structural	3 (42.9%)
	Non-CNS etiology	0 (0%)
	Unknown	0 (0%)
Reason for admission[a]	Seizures	3
	Status epilepticus	1
	Mental status changes	0
	Cardiac arrest	1
	Respiratory distress	2
Indication for cEEG[a]	Clinical suspicion of seizures	4
	Encephalopathy	3
	Intracranial pressure monitoring	0
	Assessment of response to treatment	1
	Other indications	1
Fourth episode N = 5		
Age at the episode (in years)		10.08 (4–10.5)
Gender	Male	3 (60%)
	Female	2 (40%)