Epilepsy & Behavior 62 (2016) 176–179

Contents lists available at ScienceDirect

Epilepsy & Behavior

journal homepage: www.elsevier.com/locate/yebeh

Brief Communication

Prone sleeping and SUDEP risk: The dynamics of body positions in nonfatal convulsive seizures

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ARTICLE INFO

Article history:
Received 24 April 2016
Revised 15 June 2016
Accepted 16 June 2016
Available online xxxx

Keywords:
Sudden unexpected death in epilepsy (SUDEP)
Epilepsy
Semiology
Prone position

ABSTRACT

Background: Most victims of sudden unexpected death in epilepsy (SUDEP) are found prone with signs suggestive of an unwitnessed convulsive seizure (CS). Prone sleeping has been proposed as a risk factor for SUDEP. Little is known, however, about the change of body position during the course of CSs.
Methods: We retrospectively reviewed video-EEG data and assessed body positions during the course of CSs, until there was a physical interaction by nursing staff with the subject.
Results: We identified 180 CSs in 90 individuals. In 16 of the 180 CSs (9%), the subject started in or turned to the prone position. Of the seven CSs that started in the prone position, three turned to a lateral position during the CS. In 13 CSs, the subject was in prone position at time of nursing intervention; nine (69%) of these started in a nonprone position.
Discussion: Our data suggest that the prone position occurs infrequently in closely supervised nonfatal CSs, a notable contrast to the number of victims of SUDEP found prone. Whether prone sleeping prior to CSs increases SUDEP risk, however, remains speculative, as body position during the course of a CS appeared to be dynamic.

1. Introduction

Sudden unexpected death in epilepsy (SUDEP) is a poorly understood complication of epilepsy. The majority (73%) of all reported SUDEP cases are found in the prone position [1]. In view of a possible association between this and SUDEP, it has been debated whether prone sleeping increases SUDEP risk, and the prone position has even been included in safety checklists [2–4]. Because of similarities with sudden infant death syndrome (SIDS), a "back-to-sleep" campaign to prevent SUDEP has been promoted by some [1] while others argue that versive body turning rather than prone sleeping is a SUDEP risk factor [5].

In nonfatal convulsive seizures (CSs), body version seems common: versive body turning (up to 90°) was found in 23 of 51 focal-onset CSs [6] and whole body version (of at least 180°) in 12 of 277 epilepsy surgery candidates [7]. Body position changes in nonfatal CSs have not been reported. We aimed to explore the dynamics of body position in CSs. We hypothesized that body positions vary during the course of CSs.

2. Methods

2.1. Selection

We reviewed the video-EEG database from two tertiary epilepsy referral centers, in Bonn, Germany, and Heemstede, Netherlands. The databases were previously described [8,9]. Presurgical video-EEG reports from between 2003 and 2011 of all people aged 15 years and older were reviewed, and reports mentioning one or more recorded CSs were selected [8,9]. Those with whom the nursing staff had a physical interaction (such as touching) prior to seizure onset and those with video recordings that did not allow assessment of body positions were excluded.

2.2. Collection of variables

We collected data on the following: sex, age, epilepsy classification (symptomatic or cryptogenic/idiopathic), age at onset, duration of epilepsy, CS frequency, state of wakefulness before seizure onset (awake/asleep), learning disability (yes/no), lesion on MRI (yes/no), localization of EEG seizure onset (temporal/extratemporal), and occurrence of postictal generalized EEG suppression (PGES) lasting more than 20 s (yes/no).

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http://dx.doi.org/10.1016/j.yebeh.2016.06.017
1525-5050/

Body position categories were defined as follows: (1) prone: lying on the front, upper body lifted less than 45° from horizontal plane, and angle between shoulders and horizontal axis <45°; (2) supine: lying on the back, upper body lifted less than 45° from horizontal plane, and angle between shoulders and horizontal axis <45°; (3) lateral: right or left, angle between shoulders and horizontal axis >45° and <135°, and upper body lifted less than 45° from horizontal plane; (4) sitting: angle between upper body and horizontal axis >45° and <135°; and (5) standing: standing or walking.

Body positions were scored by one author (SS), and the timing was related to the phase of the CS. In case of uncertainty, either RDT or RS was consulted to reach consensus. Body position data were included until there was a physical nursing intervention.

2.3. EEG evaluation

Conventional scalp EEG recordings (International 10–20 System) (Stellate Harmonie, Stellate Systems, Montreal, QC, Canada) were performed at a sampling rate of 200 Hz. The end of the CS was defined as the time of the last muscular jerk.

2.4. Statistical analysis

We assessed the association between prone position during the CS and other seizure characteristics with the Mann–Whitney U test for continuous and χ^2 test for categorical variables. Only those variables with $p < 0.05$ were considered significant. Correction for multiple testing was made using the Bonferroni method. Where significant associations occurred, we corrected for the correlation between seizures in the same individual using generalized estimating equations (GEE). Statistical analysis was performed with IBM SPSS Statistics 23.

3. Results

We identified 189 CSs in 92 individuals. Six CSs were excluded as there was a physical interaction prior to seizure onset and three as the video did not allow assessment of body position. After exclusions, 180 CSs in 90 individuals remained. Most had a focal onset (n = 171, 95%). Clinical and seizure characteristics are shown in Supplementary Table 1.

3.1. Nursing intervention

Nearly all CSs prompted the nursing staff to intervene (n = 174, 97%): at the start of the clonic phase, 43% remained untouched and, at offset, only 16%. As a result of the nursing interventions, most of the body position data are based on the first part of the CS (Fig. 1).

3.2. Body position change

In 45% of all 180 CSs (n = 81), the body position changed spontaneously during the course of the seizure. The most common transition was from lateral to supine (n = 37). The majority of position changes were observed during the tonic (n = 35) and focal phases (n = 32).

3.3. CS and prone position

Seven of the 180 CSs started in the prone position (4%), and in nine CSs, the subject turned prone during the CS (5%). The median time spent in the prone position was 32 s (IQR: 14–29 s).

Of the 7 CSs in which the subjects started in the prone position, three turned to a nonprone position. At the time of the nursing intervention, prone position was noted in 13 CSs (Table 1). Of these 13 CSs, the subject started in a nonprone position in nine (69%).

In CSs arising from sleep (116 of 180 CSs, 64%), the individuals were more likely to be in the prone position at some point during the course of the CSs (14 of 16, 88%) than in nonprone (102 of 116, 62%; χ^2, p = 0.044). This difference, however, was not significant after correction for multiple testing (significance level: p = 0.007).

During seizures in which the subject was prone at some point, a higher rate of spontaneous body position changes was seen compared with that in nonprone seizures (χ^2, p = 0.002), while nursing

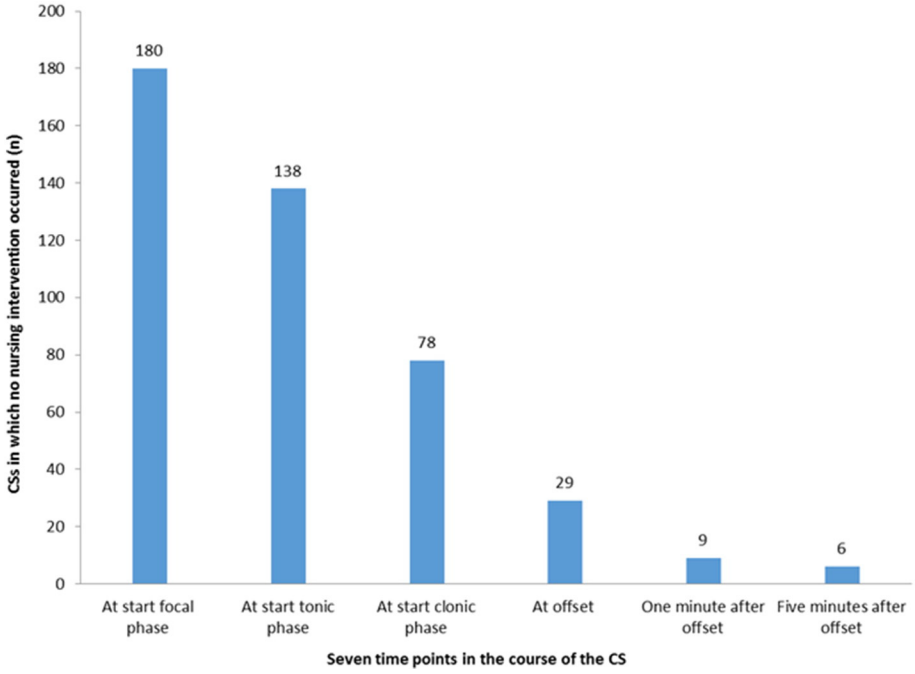

Fig. 1. Number of CSs in which no physical nursing intervention had occurred at seven time points during the course of the CS. For the seizures without focal onset (n = 9), the time of focal onset was taken at the same time the tonic phase started. CS = convulsive seizure.