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The incidence of peri-ictal prone position in patients with generalized convulsive seizures

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ABSTRACT

Objective: The objectives of this study were to determine the incidence of peri-ictal prone position in patients with generalized convulsive seizures (GCS) and to further assess the risk of sudden unexpected death in epilepsy (SUDEP) associated with the prone position.
Method: We retrospectively reviewed the video-EEG data of 308 GCS in 193 patients who underwent long-term video-EEG monitoring in two epilepsy centers. We determined the peri-ictal (preictal, ictal, and/or postictal) body positions.
Results: A peri-ictal prone position was observed in 12 (6.2%) of 193 patients and 13 (4.2%) of 308 GCS. In 5 (1.6%) of 308 GCS, patients in nonprone positions at seizure onset turned into the prone position during versive seizures. In 8 (2.6%) of 308 GCS, patients were sleeping prone at seizure onset. Peri-ictal intervention with body repositioning was provided in 11 of 12 patients and 12 of the 13 GCS. Repositioning was not provided during the remaining seizure; the patient died in the prone position. In the subset of 96 GCS without ictal intervention, patients in a supine position at seizure onset remained in the supine position at seizure termination in 57 (98.3%) of 58 GCS. Patients sleeping prone at seizure onset remained in the prone position at seizure termination in 4 (80%) of 5 GCS.
Conclusion: Our data suggest that the incidence of peri-ictal prone position in patients with GCS is low. Both prone sleeping and forced ictal version may result in postictal prone position. Although avoiding prone sleeping may reduce the SUDEP risk, influencing forced ictal version may be difficult in the absence of supervision.

1. Introduction

Sudden unexpected death in epilepsy (SUDEP) is a leading cause of premature mortality in patients with chronic uncontrolled epilepsy [1]. Comparing years of potential life lost from SUDEP with other neurological diseases, SUDEP ranks second only to stroke [2]. Sudden unexpected death in epilepsy commonly occurs during sleep, in bed, and unwitnessed [3,4]. A recent systematic review showed that 73% of all reported SUDEP patients were found in a prone position at the time of death [5], suggesting that sleeping prone might be a risk factor for SUDEP. Although the mechanism of SUDEP remains unclear [6], SUDEP commonly occurs in patients with uncontrolled generalized convulsive seizures (GCS) [7,8]. Postictal generalized EEG suppression (PGES) is a common EEG pattern associated with the GCS [9] and is consistently correlated with postictal coma [10,11]. The impaired arousal in postictal patients may compromise the brainstem autoresuscitation mechanism and prevent them from lifting or turning their heads, at a time when their airways are obstructed by soft bedding in the prone position [12,13]. Among the 11 published video-EEG-monitored SUDEP cases, GCS, PGES, and prone position were observed in all the victims [5]. Therefore, the cascade of GCS, PGES, and prone position may be an important mechanism of SUDEP.

Similar to sudden infant death syndrome (SIDS), a "Back to Sleep" campaign has been advocated for SUDEP prevention [5,14]. However, prone sleeping immediately prior to the agonal seizures has rarely been reported in SUDEP studies. The dynamics of spontaneous body positions during convulsive seizures are poorly characterized. As such, the utility of a "Back to Sleep" campaign for SUDEP prevention is unknown. Among the monitored SUDEP cases in the study of Mortality in Epilepsy Monitoring Unit (MORTEMUS), 4 of 11 patients were sleeping prone prior to seizures, while 5 of 11 patients turned into prone position from nonprone positions during versive seizures [15,16]. This finding led to the argument that forced ictal version, rather than prone sleeping,

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might be an important SUDEP risk factor. The aims of this study were to determine the incidence of the peri-ictal prone position in patients with GCS and to further assess the SUDEP risk associated with the prone position.

2. Methods

We retrospectively reviewed the medical records and video-EEG recordings of patients who underwent long-term video-EEG monitoring in adult epilepsy centers at the University of Chicago, IL, USA and Zhejiang University, Hangzhou, China. The patients from both centers were included in previously published reports [10,17].

Video-EEG recordings were performed using 26 channels with electrodes placed in the international 10–20 system and a single channel of EKG. During video-EEG monitoring, antiepileptic drugs (AEDs) were reduced or discontinued to facilitate the recording of habitual seizures at the discretion of the attending physicians. Nursing interventions such as nasal oxygen treatment, oral suctioning, and body repositioning were performed at the discretion of the nursing staff. Data were acquired by two clinical neurophysiologists in each center (SG and JXT in USA and JX and SW in China). The institutional review board approved the study in each center.

We collected the following variables: age, sex, age at seizure onset, epilepsy duration, epilepsy syndrome (partial or generalized), and state of wakefulness (awake or asleep) at seizure onset. The body positions were categorized into the following: 1) supine: lying on the back with the upper body elevated less than 60° from the horizontal plane; 2) prone: lying on the abdomen with the upper body elevated less than 60° from the horizontal plane; 3) lateral: lying on the left or right side with the upper body elevated less than 60° from the horizontal plane; 4) sitting: the upper body elevated more than 60° from the horizontal plane; 5) and standing.

Peri-ictal body position is defined as the position starting at 2 min before, during, and ending at 2 min after the clinical seizure. Preictal body position is defined as the body position at the time of clinical seizure onset. Postictal body position is defined as the body position at the time of clinical seizure termination. Ictal intervention is defined as any direct body contact (e.g., oxygen administration, oral suctioning, or body repositioning) between nurses and a patient during the ictal phase, which would prevent spontaneous changes of a patient's body position during a seizure. Verbal communication is not considered ictal nursing intervention in this study.

3. Results

A total of 193 patients with 308 GCS were included from two centers, 109 patients with 150 GCS from the University of Chicago epilepsy center and 84 patients with 158 GCS from the Zhejiang University epilepsy center. Patient and seizure characteristics are summarized in Table 1.

Table 1
Characteristics of patients and generalized convulsive seizures.

Number of patients (n)	193
Number of seizures (n)	308
Age, years ± sd	30.2 ± 12.7
Gender (%)	Female (52.3); Male (47.7)
Age of onset, years ± sd	12.6 ± 9.7
Epilepsy duration, years ± sd	16.4 ± 11.3
Epilepsy syndromes (%)	
Generalized	25 (13)
Partial	178 (87)
State of wakefulness (%)	
Awake	177 (57.5)
Sleep	131 (42.5)
Ictal intervention (%)	
Yes	212 (68.6)
No	96 (31.4)

Fourteen GCS were excluded from the study because the video recording was obscured in the peri-ictal period and body positions could not be assessed.

Pre- and postictal body positions of patients were assessed in the 308 GCS with and without nursing intervention during the ictal phase. At the time of seizure onset, a supine position was observed in 155 (50.3%) seizures, a lateral position was observed in 74 (24%) seizures, a sitting position was observed in 69 (22.4%) seizures, a prone position was seen in 8 (2.6%) seizures, and a standing position was observed in 2 (0.6%) seizures. At the time of seizure termination, a supine position was observed in 216 (70.1%) seizures, a lateral position was observed in 80 (26%) seizures, a sitting position was observed in 8 (2.6%) seizures, a prone position was observed in 4 (1.2%) seizures, and a standing position was not observed in any seizures.

Further analysis revealed that a peri-ictal prone position was observed in 12 (6.2%) of 193 patients and in 13 (4.3%) of 308 GCS. Because of the SUDEP risk associated with the prone position, we assessed how the 12 patients in the peri-ictal prone position transitioned into and out of prone position during their 13 seizures (Table 2). We initially consider the patients who were prone sleeping at the time of seizure onset, which was the case in 8 (2.6%) of 308 GCS. Patients in 3 of these seizures were repositioned to a lateral position by the nursing staff during the seizures. During one GCS, the patient turned into a lateral position spontaneously. In 3 additional seizures, patients were repositioned by the nurses to a lateral position soon after seizure termination. Unfortunately, nursing intervention was not provided in the remaining agonal seizure, and the patient subsequently died in the prone position.

We next consider the patients who were not sleeping in a prone position at the time of seizure onset but turned into the prone position during the ictal phase; this was the case in 5 (1.7%) of 308 GCS. Three of these patients turned into the prone position from a lateral position during versive seizures. One patient turned into a prone position from a supine position during a versive seizure. One patient flipped into the prone position from the supine position during a hypermotor seizure. All 5 patients were repositioned by the nursing staff during their seizures.

The dynamics of spontaneous body position changes were investigated in the subset of 96 GCS without ictal intervention. At the time of seizure onset, the supine position was the most frequent (58 of 96; 60.4%), followed by the lateral position (20; 20.8%), the sitting position (13; 13.5%), and the prone position (5; 5.2%). The vast majority of patients in the preictal supine or prone position remained in the same position at the time of seizure termination, while only a minority of patients in a preictal lateral and sitting position remained in the same position. At the time of seizure termination, the supine position was again the most frequently observed (79 of 96; 82.3%), followed by the lateral position (10; 10.4%), the prone position (4; 4.2%), and the sitting position (3; 3.1%). Patients in a supine position at seizure onset

Table 2
Peri-ictal prone position in 13 generalized convulsive seizures.

Patient	Age/sex	Seizure	Preictal position	Ictal position	Postictal position	Peri-ictal intervention
1	24/F	1	p	P→L	L	Ictal
2	27/M	2	P	P→L	L	Ictal
		3	P	P	P	Postictal
3	50/F	4	S	S→P→L	L	Ictal
4	45/M	5	L	L→P→L	L	Ictal
5	36/M	6	S	S→P→L	L	Ictal
6	44/F	7	P	P	P	No
7	30/M	8	P	P→L	L	Ictal
8	44/F	9	P	P	P	Postictal
9	18/M	10	P	P→L	L	Postictal
10	14/F	11	P	P	P	Postictal
11	21/F	12	L	L→P→S	S	Ictal
12	36/M	13	L	L→P→S	S	Ictal

S: supine position; L: lateral position; P: prone position. F: Female; M: male.