ORIGINAL ARTICLE

Temporal Lobe Epilepsy Causes Reduction in Rapid Eye Movement Sleep by Circadian and Nocturnal Seizures

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ABSTRACT

Background: Subjects having concise, complex partial seizures commonly suffering from fatigue and decreased efficiency that maintain well ahead of the post-icteric period. A probable clarification is that seizures, even when experience during the day, interrupt sleep the subsequent night.
Methods: For recorded electroencephalography (EEG) monitoring patients with temporal lobe epilepsy were admitted. Underneath three situations thru out night polysomnography (PSG) was documentated: Seizure free time, Seizure in day time earlier than the recording and Seizures for the period of the recording. During each sleep stage percentage in time, Sleep efficiency, and Time to first and second rapid eye movement (REM) sleep period were compared for seizure vs selected control situation. Daytime drowsiness was also calculated, using a modified maintenance of sleeplessness test and two subjective sleepiness tests.
Results: Daytime seizures reduced REM from 22% ±1% to 15.3%±1% (*P*=.003). Night seizures reduced REM from 18.4%±1% to 8.9%±1% (*P*<.001). A seizure during night also considerably reduces stages 2 and 4 at the same time as increasing the stage 1 of sleep. Night seizures, but not day seizures, significantly reduced sleep efficiency, increased time to first REM period, and increased drowsiness as measured by the maintenance of wakefulness test.
Conclusion: It is observed that temporal lobe complex partial seizures decrease REM sleep, primarily when occurring during sleep and also while taking place on the preceding day. This might, be dependable for that some patients report following seizures had experience delayed impairment of performance.
Keywords: Complex partial seizures, Post-ictal period, Temporal lobe epilepsy, Rapid eye movement (REM), Electroencephalography (EEG), Polysomnography (PSG).

INTRODUCTION

Epileptic seizures characteristically last not more than two minutes; however, patients possibly will complaint of reduction in routine performance for many days after that attack. In reports patient with epilepsy complaints two important symptoms in which excessively drowsiness in day time and sleep disturbance are main concerns, which in turn themselves might enough to impede with patient's work ability in any sector. There are many causes for these symptoms. As epileptic seizures might disturb sleep pattern and be accountable for drowsiness in day time. Antiepileptic drugs may upset sleep, even though their effects are changeable and frequently complicated to differentiate from effects of seizures. Lastly, the primary disease process causing seizures may be dependable for alterations in sleep[1].

In this study, whole night PSG was performed in patients with epileptic seizures who are already intractable, and was admitted in monitoring units of epilepsy to conclude changes produced in sleep pattern. Recordings in which seizures occurred during the night or during the previous day were compared with recordings in the similar patients while no seizure occurs for 24 hours at least. The effects of individual seizures were examined separately of other variables. By using of patients as their own individual controls[2].

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MATERIAL AND METHODS

To examine a relatively homogeneous population, only patients with temporal lobe partial epilepsy on the basis of inter-ictal and ictal PSG and EEG recordings were integrated. Already diagnosed or suspicious sleep disorder subjects were not included in this study, even though no particular testing was done for sleep apnea or periodic limb activities was carrying out. No subject had completely diurnal or nocturnal seizures. Patients were admitted one after the other to the Epilepsy Monitoring Units of Lahore General Hospital in Pakistan, for diagnosis or further surgical assessment. On the basis of video-electroencephalographic EEG monitoring temporal onset seizures were verified, and computerized seizure detection make sure that un-witnessed seizures were also reported. Many patients were getting continuation anticonvulsant treatment, even though this was characteristically reduced and occasionally discontinue during the admission. Patients taking or noncompliant for treatment were excluded. Caffeine containing drinks were not acceptable. By using video-EEG Seizures were diagnosed with the full

scalp array electrodes. The night sleep deprived and daytime naps participants were not allowed during and before recordings[3]. Subjects were previously informed or instructed to go on sleep at 11:00 pm and wakened at 7:00am. The doors of the room remained closed during sleep pattern recordings, the lights were off, and the patients without interruption except a seizure occur. Patients were encouraged to go back to sleep after seizures. If subject using anticonvulsant drugs was taking after protracted or frequent seizures, this night was not integrated in the study. Staging the adult (PSG) score sleep stages in 30-second epochs, according to brooks recording and scoring manual, by reconstruct digital EEG to (PSG) channels and settings. Scoring always commence at sleep onset (defined by in 1 stage 3 consecutive epochs and in stage 2 sleep1 epoch) and continuous until arousing by the staff in the morning. Consequently, sleep latency could not be resolute, and total recording time speckled to some extent. Sleep competence is in general termed as time asleep as a proportion of point in time in bed (lights off to lights on phenomenon). For this study sleep efficiency was calculated rather in a different way from the standard way, as fraction of time asleep from sleep commencement waiting arousing. This would to be expected outcome in elevated figures, but contrast between groups should still be applicable. Sleep next to seizure was attain as post-ictal sleep in anticipation of the 1 epoch of standard stage 2 sleep or alertness was seen, following that position, the standard criterion for sleep performance were used. Because disperse delta classically seen following seizures is clearly not identical with the customary sleep stages. By using this method, stages 3 and 4 sleep probably could be miscalculate, but it would be unusual for patients to pass directly into these stages without first incoming stage 2. Correspondingly, mild slowing and lessening seen post-ictally would not be scored as stage 1 sleep.[4] The first night of recording were not included in the statistical analysis, due to organize for first-night effects. Nevertheless, subjects adhered to the sleep timetable on that night. Control recordings (PSG) were termed as no episode of seizure for at least in 24 hours previous to sleep beginning and during the recordings. (PSG) subsequent daytime seizures DAYSZ states were defined as a seizure between 7 AM and 11 PM on the day the recording began. (PSG) with night seizures NTSZ state were defined as a seizure during the (PSG) recordings after sleep commencement. Patients were identified who had at least 1 control and 1 DAYSZ or NTSZ (PSG); these were used in the succeeding analysis. Sleep effectiveness, proportion of time in every sleep stage, time to 1st and 2nd REM phase, and whole sleep time were calculated. For nights among seizures, a sub-analysis is made while seizures occur ahead of or after the 1st REM phase. Between 1:00 to 3:00pm daily, patients were administer three tests of sleepiness. Individual procedures integrated the Stanford Sleepiness Scale (SSS), in which the subjects select and details are giving in a numerical form like results from 1 to 7, and a linear analog size of drowsiness (LASD). From alert to sleepy, subjects were asked to score their level of drowsiness on a 100-mm line, compliant a result from 0 to 100. All tests were performed on day's meeting the inclusion criteria for the (PSG) portion of the study, and therefore were not performed on the day of admission or on the following day. All study results were evaluated by using a paired *t* test vs. controls. When more than one suitable test was obtained, the results were averaged prior to comparison by using the paired *t* test. When data were not normally spread, non-parametric statistics were used[5].

Table 1: Distinctiveness of Study Recordings

	Seizure Condition	
	DAYSZ	**NTSZ**
No. of recordings	90	90
No. of male-female subjects	12:20	12:20
Age range (mean), y	25-65 (44)	25-65 (44)

RESULTS

A total of 128 nights were recorded in 32 patients (5 nights per patient). Recording characteristics are summarized in Table 1, our analysis used those recordings 90 recordings in all the patients in whom control and seizure conditions were both recorded. 11 subjects out of 32 participants had DAYSZ and NTSZ recordings. The average time was 8.5 hours during which recordings were obtained. The average time from daytime seizure to start of recording was 11.4 hours. Of the all 32 patients, 16 have control recordings initially 6 of these also have control recordings after 1 seizure recording. The mean number of appropriate recordings per subject was 3.4 (ranging between 1-5) for control, 1.6 (ranging between 1-3) for DAYSZ, and 1.4 (ranging between 1-2) for NTSZ states. Results are specified as mean±SEM. DAYSZ indicates a seizure happen between 7 AM and 11 PM on the same day of the recording; NTSZ, a seizure occurs during the night-time recording. Sleep stages 1 through 4 did not affected by daytime seizures. However, REM period was significantly reduced (14%±1% vs 20%±1%; *P*=.003). Night seizures caused an increase in stage 1 sleep (19%±1% vs 15%±1%; *P*=.002) and decreases in stage 2 sleep (49%±1% vs 51% ± 1%;*P*=.004), stage 3 sleep (3.8%± 0.4% vs 5.3%±0.8%; *P*=.046), and in stage 4 sleep (9.7%±1% vs 18%±1%; *P*<.001). For nights when the seizure occurred before the first REM period (n = 7), REM sleep was further reduced (5.9%±1% vs 18% ± 1%; *P*=.002).

Table 2: Sleep structure after seizures

Day time seizures	**Night seizures**
REM Sleep vs Non REM Sleep	
In stages 1 throughout 4	**In stage 1 sleep**
14%±1% vs 20%±1%; *P*=.003	9%±1% vs 15%±1%;*P*=.002
	In stage 2 sleep
	49%±1% vs 51%±1%;*P*=.004
	In stage 3 sleep
	3.8%±0.4% vs 5.4%±0.9%; *P*=.046
	In stage 4 sleep
	9.7%±1% vs 18%±1%; *P*<.001
	For nights when the seizure occurred before the first REM period (n = 7)
	5.9%±1% vs 18%±2%;*P*=.002

Seizures in daytime increases the time from sleep onset to the period of first REM (190±30 vs 126±09 minutes), even though this difference was not proven significant (*P*=.08). Night seizures significantly increased

the time period to first REM (225±34 vs 126±28 minutes; *P*=.008). While seizures occurred prior to the first REM period, the difference was more striking (371±23 vs 125 ± 13 minutes; *P*<.001). The time from the beginning of the first REM period to the commencement of the second was not dissimilar for any other group.

There were no considerable differences in a total recording duration for NTSZ (425 ± 05 vs 439 ± 05 minutes) or DAYSZ situation (450 ± 08 vs 449 ± 5 minutes) in comparison with controls for every group.

Table 3: After sleep onset time to REM period

Day REM period	**Night REM period**
1st REM period	
190±30 vs 126±09 minutes (*P*=.09)	225±34 vs 126±28 minutes; (*P*=.008)
When seizures occurred before the first REM period	
371±23 vs 125±13 minutes (*P*<.001	
Total recording duration	
450 ± 08 vs 449 ± 5 minutes	425±05 vs 439±05 minutes

DISCUSSION

These data propose with the aim that complex partial seizures intensely disturb night-time sleep, even while they occur during the day-time. Seizures, both diurnal and nocturnal decreases REM sleep period. Seizures increased stage 1 sleep and decreases stages 2 and 4 sleep. There are numerous potential rationales for reduce REM sleep in patients with seizures. The first is basically that sleep is additionally disturbed, with more recurrent awakenings and with a reduction of time with sleep. A next reason is that seizures influence the circadian pattern accountable for REM sleep, therefore delays its onset. This is maintaining by the increased time to first REM period with all seizures except for diurnal seizures. Third, psychological factors also affect the sleep as patients know that they have seizures. Finally, seizures might have a direct REM suppressant effect without interference of circadian rhythms. Only on nights decrease in REM sleep with widespread or numerous partial seizures when in compared with healthy controls it is found that decreases in total sleep time and REM sleep when patients with seizures were comparison with patients having no seizures. Multiple studies performed on patients with epilepsy in which single-night recordings were taken and in compared with controls healthy subjects, illustrate no significant change or decrease in REM sleep in patients having epilepsy.[6] In all ongoing studies, anticonvulsants drugs are continuously taking by epileptic patients, which lead to alters sleep pattern. This is predominantly significant while comparisons between with normal controls with no anticonvulsants drugs intake. Finally, all of these studies unsuccessful to control for the presence of daytime seizures, which (in our analysis) also influences the sleep. By using patients as their own controls in this study group controlled for any effects of the primary disease process. To some extent this method also controls for anticonvulsant effects during recordings. Even though anticonvulsant treatment classically was tapering for the duration of admission, in a broad-spectrum, patients take smaller quantity of drugs while seizures occurred than on control nights. Even though this did not particularly record, at therapeutic level the number of recordings with no anticonvulsant in this study was similar for the three study situations. Consequently, any sleep disturbance after taking anticonvulsant therapy would be anticipated to affect the control nights as in seizure nights. This study in particular addresses seizures with temporal lobe onset; other seizure types like frontal lobe or primary generalized epilepsy) might affect sleep in a different way. There are some limitations in this study. As circumstances were not optimal for sleep because of a laboratory environment, even though this limits the significance of baseline data, the distinction between seizure and seizure-free studies supposed to be convincing. There was no baseline sleep record, so it is probable that patients were comparatively sleep deprived during admission. If this was correct, many patients have control recordings at first, since REM rebound may have contributing to relatively increase in REM during control nights. For that reason patients having temporal lobe epilepsy constantly cycle between REM deprivation and rebound. Therapy was typically tapered during admissions, and specific doses were not recorded. Conversely, the percentage of recordings with no anticonvulsant at therapeutic level in this study was 27% (14/50) for control, 34% (7/20) for DAYSZ, and 30% (6/17) for NTSZ state. Precise lights-off times were not recorded, so the important measure of sleep latency could not be calculated. As respiratory measures were not included, it is likely that undiagnosed sleep apnea was present in some of the patients, which could provoke seizures and aggravate baseline sleep disturbance. In this study our goal is only look for finding differences with seizure incidence in the same patients, this confounding factor would only be significant if seizures induced or exacerbated the sleep apnea. This prospect could be investigated with formal sleep studies.[7]

CONCLUSION

REM sleep has also been concerned in learning and memory consolidation. Consequently, REM sleep deficit could be accountable for the dullness and decrease in its efficiency that many patients experience followed by seizures. Deprivations of REM sleep not causing drowsiness; Patients with nocturnal seizure having decreased sleep efficiency. It is also observed that overall disruption in circadian rhythms which include temperature and melatonin secretion leads to changes in REM sleep. Disturbance of these patterns evidently causes decreased functioning, as demonstrated in the disorders of jet lag and shift work. However, evidence recommends that secretion of melatonin is interrupt by seizures.

On the whole, this study shows that temporal lobe complex partial seizures interrupt especially REM sleep, predominantly when taking place early in a night's sleep but even when they occurred several hours before sleep onset. Further detailed studies will be required to conclude whether likewise altered sleep patterns were seen in patients with additional types of epileptic seizures.

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