ORIGINAL RESEARCH PAPER

Volume-7 | Issue-5 | May-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A POLYSOMNOGRAPHY STUDY OF EEG AROUSALS FROM NOCTURNAL SLEEP FROM INDIA

Psychiatry

Dr. Rahul Mathur MD Psychiatry, Senior Resident, Department of Psychiatry, MGM Medical College, Indore (M.P.)

Dr. Aparaajita Upadhyay* MS ENT, Senior Resident, Department of ENT, MGM Medical College, Indore (M.P.) *Corresponding Author

Dr. Mohit Naredi MD Medicine

ABSTRACT

During polysomnography brief arousals are clinically important and increasingly scored. However, the frequency of arousals during routine polysomnography in the normal population is unknown. We performed overnight polysomnography in the 55 control subjects from a general private practice list who were approached and agreed to undergo polysomnography. Awakenings were scored according to the criteria of the American Sleep Disorders Association (ASDA). There was a mean of 4 (95% confidence interval (CI)), awakenings per hour, whereas the ASDA definition gave 21 per hour slept. In our subjects, arousal frequencies increased significantly ($p < 0.001$) with age, who ranged from the late teens to early 70s. The high upper limit of the frequency of brief arousals was not altered by exclusion of patients who snored or had witnessed apneas or daytime sleepiness. It is important that those scoring arousals on routine polysomnography recognize that high arousal frequencies occur in the normal population on night polysomnography.

KEYWORDS

Arousals-Polysomnography-Sleep.

Introduction

Sleep is a temporary state of unconsciousness that can be interrupted by external stimuli. Arousals are brief neurological awakenings and are a normal feature of sleep. In the sleep apnea/hypopnea syndrome, the degree of cognitive deficit [1] and the severity of sleepiness relate to the frequency of arousals.[2] Nocturnal elevations in blood pressure, both in the sleep apnea/ hypopnea syndrome [3] and the periodic limb movement disorder [4] ,also relate to arousals. The upper airways resistance syndrome apnea/ hypopnea syndrome [3] and the periodic limb movement disorder [4], also relate to arousals. The upper airways resistance syndrome is defined in terms of recurrent arousal associated with increased respiratory effort [5]. Thus, arousals are increasingly being scored as part of routine assessment of clinical sleep studies.

The frequency of arousals during an overnight sleep study in the normal population needs to be known to allow adequate interpretation of sleep study results. Previous studies have examined the frequency of brief awakenings in normal subjects [6] but have not looked at the frequency of briefer arousals in the normal population on the first night in a sleep laboratory, the situation found in clinical practice.

A similar study has been conducted in Edinburgh, Scotland [7] and has found similar results but none of such studies have been conducted in India to the best of our knowledge.

We have, therefore, determined the frequency of arousal in normal subjects during a I-night sleep study in our laboratory. Arousal may be determined by many criteria, including electroencephalographic (EEG), cardiovascular or respiratory. We have chosen to investigate EEG criteria because these are currently the most widely used in sleep laboratories. We have examined the criteria of Rechtschaffen and Kales [7] for classical awakenings, along with the American Sleep Disorders Association (ASDA) definition of briefer arousals [8], based on a 3-second change in EEG and the ASDA definition, modified so that briefer (1.5-second) EEG changes constitute an arousal.

Materials and Method

We approached 30 subjects from a private general practitioner's register, of whom 28 agreed to participate. These subjects were chosen as age, sex, height and weight matched controls for another study [9]. None of the subjects had a previously diagnosed sleep disorder. All were invited for a single night polysomnography in our sleep laboratory.

Polysomnography used our standard procedures [10], including recording EEG, electrooculogram, submental electromyogram (EMG) and anterior tibial EMG. In addition, airflow at the mouth and nostrils was measured by thermocouples, thoracoabdominal movement by plethysmogram. All the data were recorded in a 16-channel polygraph. Sleep and respiratory event scoring was done manually, per standard criteria, with a 20-second epoch length [7].

From this scoring, an awakening was defined as follows: Contiguous epochs scored awake with less than 10 seconds intervening sleep were counted as one awakening. Each non contiguous epoch scored awake was counted as one awakening. Awakenings could be scored during an epoch of recording scored awake by the Rechtschaffen and Kales criteria. Awakenings were not scored on the basis of submental EMG changes alone. Artefacts including those by pen blocking, K complexes or delta waves were not scored as awakenings unless accompanied by a contiguous EEG frequency shift. Non concurrent but contiguous EEG and EMG changes individually less but together more than 10 seconds' duration were not scored as awakenings. Last, transitions from one sleep stage to another alone without an intervening defined arousal were not scored as awakenings.

Arousal scorings were done on each sleep record by the same observer using the two ASDA different definitions. Each definition required the subject to be asleep for at least 10 continuous seconds before an EEG arousal could be scored.

ASDA 3-second definition: Any shift in the EEG frequency to alpha or theta for at least 3 seconds irrespective of any change in submental EMG during nonrapid eye movement (NREM) sleep but accompanied by a concurrent 3-second in-crease in submental EMG amplitude during rapid eye movement (REM) sleep [8] was scored as an awakening by the ASDA 3-second definition.
ASDA 1.5-second definition: Any shift in the EEG frequency to alpha or theta for at least 1. 5 seconds, irrespective of any change in submental EMG during NREM sleep, but always accompanied by a 1.5-second increase in submental EMG amplitude during REM sleep was scored as an awakening by the 1.5-second ASDA definition.

Statistical analysis

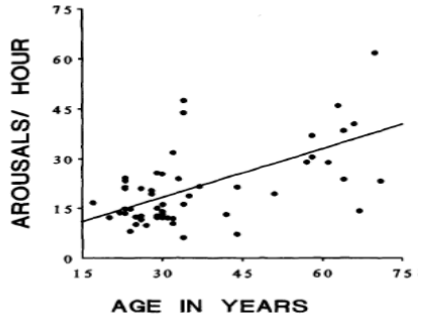
Arousal indices, defined as total number of arousals per hour slept, were calculated for each definition used. Data was analyzed using the SPSS-PC program and arousal frequencies compared between definitions by repeated measures analysis of variance with subsequent paired t testing. Local Ethics Committee approval was obtained for the study.

Results

A total of 28 subjects (14 males and 14 females) were recruited for the

study. They had a mean age of 42 [95% confidence interval (CI) 20-70 years] and a mean body mass index of27 (95% CI 20-32 kglm2). The classical Rechtschaffen and Kales [7] sleep quality data are shown in Table 1.

The Rechtschaffen and Kales [7] definition of awakenings gave a mean of 4 (95% CI, 1-15 per hour). Using the ASDA 3-second definition of arousal gave a mean of21 (95% CI, 7-56) arousals per hour, and the ASDA 1.5 second arousal definition gave a mean of 26 (95% CI, 5-67) arousals per hour. The frequency of arousals was not different between the sexes but did increase with age irrespective of the definition of arousal.



5 of the 28 subjects reported snoring, 8 reported at least occasional daytime sleepiness and 1 had witnessed apneas. A total of 13 of the 28 subjects had snoring, daytime sleepiness or witnessed apneas. Exclusion of these 13 made no numerical difference to the mean arousal frequency for any of the three definitions and increased the 95% CIs in each case. Six of the subjects had total sleep times of <4 hours. Exclusion of these six again made no appreciable difference to the arousal frequencies.

Comparison of the frequency of arousal/awakening using the different definitions showed that the results obtained were highly significantly ($p < 0.0001$) different from each other.

This study shows that in a random sample of subjects from the normal population, arousal frequencies during I-night polysomnography are high. The frequency of arousal increases with age but in this study population was otherwise not related to sex or minor sleep related symptoms.

This study does not address the frequency of arousals in the normal population sleeping in an unmonitored fashion. To provide comparative data with routine overnight polysomnography, subjects were not acclimatized to sleeping in monitored environment. The high arousal frequencies that we have observed with relatively non invasive polysomnography indicate that recurrent arousals during routine polysomnography may occur in the absence of a major sleep-related illness and that they must be interpreted with caution.

This study used two different definitions to score arousals from sleep. In each of the definitions, arousal from REM sleep required the presence of a simultaneous increase in submental EMG amplitude. This is because spontaneous and isolated bursts of alpha or theta activity during REM sleep are common events and may not necessarily indicate a physiological arousal from this sleep state. Likewise, isolated increases in sub mental EMG activity without any change in EEG frequency may not indicate arousal and have therefore not been considered as such in any of the definitions concerned.

As a separate definition, we did not attempt to count the EEG return to alpha or theta activity of less than 1.5 seconds' duration as an individual arousal as such an attempt was plagued by methodological difficulties. This was because it proved very difficult to distinguish such small events from sleep spindles. We also attempted to identify any EEG changes such as K-complexes or quickening of electrical activity at apnea/ hypopnea termination but failed to consistently identify any such EEG marker events in all sleep stages and in most if not all the subjects.

Correlational studies of arousal scoring with respiratory disturbance, with non respiratory arousal stimuli and with resulting morbidity are needed to establish the optimum definition of an EEG arousal. (1). In contrast to this latter observation, Roehrs et al. (2) found a significant correlation, in a much larger study, between respiratory arousal frequency and multiple sleep latency test (MSLT) scores, although the correlation obtained only explained 13% of the observed variance in MSLT. There is thus a need for further study of the correlation between the morbidity caused by sleep fragmentation and the extent of arousal required to produce morbidity.

Recent studies modelling the sleep fragmentation of sleep apnea in normal subjects are beginning to address this issue (11). It is likely that clinically significant arousals may occur in the absence of a visible change in EEG (2) and that the optimal definition of arousal may be either derived by computer from the EEG or may relate to respiratory or cardiovascular changes.

REFERENCES

1. Cheshire K, Engleman H, Deary I, Douglas NJ. Factors impairing daytime performance in patients with the sleep apnea hypopnea syndrome. Arch Intern Med 1992;152:538-41.
2. Roehrs T, Timms V, Zwyghuizen-Doorenbos A, Buzenski R, Roth T. Polysomnographic, performance and personality differences of sleepy and alert normals. Sleep 1990;13:395-402.
3. Davies RJO, Crosby J, Vardi-Visy K, Clarke M, Stradling JR. Non-invasive beat to beat arterial blood pressure during non-REM sleep in obstructive sleep apnoea and snoring. Thorax 1994;49:335-9.
4. Ali NJ, Davies RJO, Fleetham JA, StradlingJR. Periodic movements of the legs during sleep associated with rises in systemic blood pressure. Sleep 1991;14:163-5.
5. Guilleminault C, Stoohs R, Clerke A, Cetei M, Maistros P. A cause of excessive sleepiness: the upper airway resistance syndrome. Chest 1993;104:781-7.
6. Williams RL, Karacan I, Hursch CJ, eds. Electroencephalo-graphy (EEG) of human sleep: clinical applications. New York: John Wiley & Sons, 1974.
7. Mathur, R, Douglas, N.J. Frequency of EEG arousals from nocturnal sleep in normal subjects.Sleep. 1995;18:330–333.
8. Rechtschatfen A, Kales A, eds. A manual of standardized terminology, techniques and scoring system for sleep stages of human subjects. Bethesda, MD: National Institutes of Health, 1968: publication 204.
9. American Sleep Disorders Association. EEG arousals: scoring rules and examples. Sleep 1992; 15: 173-84.
10. Douglas NJ, Thomas S, Jan MA. Clinical value of polysomnography. Lancet 1992;339:347-50.
11. Roehrs T, Merlotti L, Petrucelli N, Stepanski E, Roth T. Experimental sleep fragmentation. Sleep 1994; 17:438-43.