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Phasic activity and the importance of irregular breathing

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Title**Phasic activity and the importance of irregular breathing.**

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PD: Concept, analysis, writing, design, interpretation and discussion; AB, SD, SH: Data acquisition, analysis, interpretation and discussion; BDK, AJW, GL: Concept, interpretation and discussion

Keywords: REM-related irregular breathing; RBD; RWA; Prozac eyes, neurodegenerative RBD

Introduction

In an illustrative case, a 45-year-old patient receiving escitalopram (10mg) daily for generalized anxiety disorder and without co-morbidities, "Prozac" eyes were observed in the polysomnographic recording (Fig.1). Retrospective analysis of relevant cases from our department did not reveal "Prozac" eyes during non-REM (NREM) 3, and when present these were not associated with REM-related irregular breathing (RespREM) (1-4).

When sleep stage-determining markers gradually become indiscernible (as can be seen in patients with idiopathic Parkinson's disease (IPD)), scoring can be difficult. Such a case is presented in figure 2 with electroencephalographic (EEG) signals of a 55-year-old male patient with IPD and without sleep disordered breathing (SDB). From our experience, the only clearly observable sleep stage characteristics in these difficult to score sleep studies are the combination of phasic activity with RespREM as an indicator of REM sleep, highlighting the strong interconnection between them (Fig. 2).

Image analysis

Slow eye movements are observed in the electro-oculography of the polysomnographic recording of this patient during NREM1 and NREM2. These eye movements are not associated with changes in breathing pattern as derived from inductance plethysmography (Fig. 1).

Rapid eye movements coincide with the presence of RespREM as derived from inductance plethysmography, in a patient with IPD and difficult to score EEG (Fig. 2).

Figure 1. "Prozac" eyes during non REM.

Example of "Prozac" eyes during four-minute epoch of non REM 1 and non REM 2 sleep stages. From the top down, the two first channels are the right and left electro-oculograms with slow eye movements, followed by F3-M2, F4-M1, C4-M1, C3-M2, O1-M2, and O2-M1, chin electromyography (EMG), left and right-leg tibialis EMG, oronasal flow and chest wall and abdomen signal from inductance plethysmography, pulse rate and pulse oximetry. Electrocardiographic artifacts can be seen in the electrooculograms.

Figure 2. Presence of rapid eye movements and REM-related irregular breathing in a difficult-to-score electroencephalography in a patient with idiopathic Parkinson's disease.

An example of a four-minute epoch with a transition between a presumed Wake to REM sleep stage. From the top down, the two first channels are the right and left electro-oculograms followed by F3-M2, F4-M1, C4-M1, C3-M2, O1-M2, and O2-M1, chin electromyography (EMG), left and right-leg tibialis EMG, oronasal flow and chest wall and abdomen signal from inductance plethysmography, pulse rate and pulse oximetry. The red bar indicates the presence of rapid eye movements with mild drop in chin EMG and prominent drop in chest wall signal and irregular breathing thereafter.

Discussion

Irregular breathing is a known characteristic of REM sleep but it is not included in the current scoring rules, primarily due to concerns of possible presence of concomitant SDB (2, 5). RespREM may be a particularly useful scoring tool in cases where SDB is not

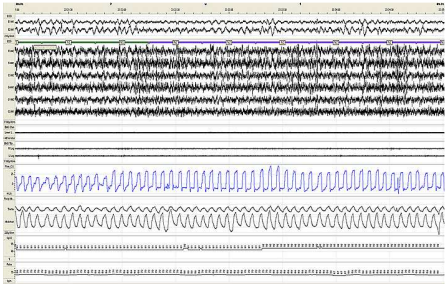
present and characteristics of REM sleep are missing (eg, REM without atonia or REM sleep behavior disorder (RBD)) (3). Phasic activity and RBD-like movements during NREM can be observed in patients with neurodegenerative RBD (6). The combination of phasic activity with irregular breathing could serve as an additional proof of REM intrusion in NREM, therefore supporting that the abnormal nocturnal behaviors observed are likely REM-related rather than NREM-generated or drug-related. It should, however, be kept in mind that irregular breathing may be transiently seen on NREM sleep during stage transition and arousal.

"Prozac" eyes are slow-rolling eye movements thought to be due to disinhibition of "omnipause neurons" in the brainstem, which normally inhibit saccadic eye movements (1). Our findings support the hypothesis that SSRI-induced eye movements during NREM do not represent REM dissociation (1).

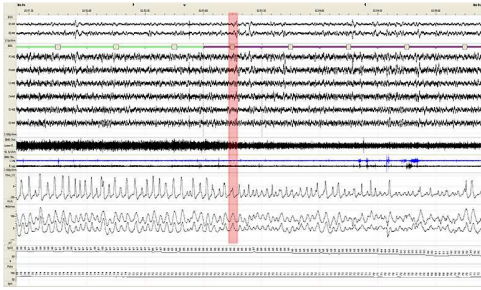
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Highlights

- REM-related irregular breathing is a cardinal feature of REM sleep.
- It can be a useful tool in identifying REM sleep and REM intrusion in NREM sleep.
- "Prozac eyes" are not associated with REM-related irregular breathing.