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Research report

Comparison of objective and subjective assessments of sleep time in subjects with bipolar disorder

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ABSTRACT

Introduction: Sleep disturbance is a core feature of bipolar disorder. To date there are a limited number of studies that compare subjective and objective measures of sleep in populations of subjects with mood disorders. This study evaluated the relationship between subjective and objective measurements of total sleep time (TST) in a bipolar type I disorder (BD I) population.

Methods: Thirty-nine subjects diagnosed with BD I participated in the study. Mood symptoms were assessed via YMRS and IDS-30-C. Subjects wore an actigraph device and maintained a sleep diary for seven consecutive days. Differences between TST as estimated via sleep diaries and actigraphy were calculated.

Results: Objective and subjective measures of TST were significantly correlated ($r=0.5151$, $p=0.0008$). Secondary analysis revealed that the severity of depressive symptoms did correlate to this discrepancy ($t=2.65$, $p=0.01$).

Limitations: The impact that medications have on the accuracy of TST reported was not investigated. Also, sleep diaries may have acted to prompt subjects to pay closer attention to their sleep habits and therefore more accurately report TST than in the average clinical setting.

Conclusion: The results of the current study demonstrate a significant correlation between the estimation of TST as measured objectively via actigraphy and subjectively via sleep diaries in BD patients. Mood symptomotology might impact the accuracy of TST reported. Further study is warranted.

1. Introduction

Sleep disturbance is believed to be a core feature of bipolar disorder (BD). Bipolar patients exhibit an array of sleep abnormalities, including variations in sleep architecture, disruption of the 24-h sleep-wake cycle and increased sleep fragmentation (Eidelman et al., 2010; Krystal et al., 2008; Plante and Winkelman, 2008). Somnographic findings in both manic and depressed bipolar subjects include a disruption in sleep continuity, increased time spent in stage 1 sleep, shortened REM latency, and an increase in the density of REM sleep (Hudson et al., 1992). Though commonly associated with affective episodes, sleep disturbance has also been reported in euthymic BD patients (Harvey et al., 2005; Knowles et al., 1986; Millar et al., 2004). Considering that sleep disruptions are associated with a worse course of illness (Eidelman et al.; Eidelman et al.), increased symptom severity Eidelman et al.; Gruber et al., 2009), impairments in functioning and quality of life (Eidelman et al.; Gruber et al., 2009), and may be initial prodromes (Skjelstad et al., 2009; Duffy, 2009; Duffy et al.), and trait markers (Gruber et al., 2009) for the illness, further research in this area is warranted.

While psychometric rating instruments used to assess symptom severity in disorders of affect contain items that characterize type and degree of sleep disturbances (Hamilton, 1960; Rush et al., 1986; Young et al., 1978; Bowden et al., 2007), to date there are a limited number of studies that compare subjective and objective measures of sleep. Previous studies in patients with major depression have reported positive correlations between subjective and objective estimates of total sleep time (TST) (Armitage et al., 1997; Rotenberg et al., 2000; Tsuchiyama et al., 2003). Some of these studies in MDD have reported a tendency toward discrepancies between subjective and objective estimates of TST (Rotenberg et al., 2000; Tsuchiyama et al., 2003). Only one study has explored the correlation between the subjective and objective estimations of TST in bipolar disorder. This study noted

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that euthymic BD patients demonstrated a greater discrepancy between subjective and objective measures of sleep when compared to insomnia and healthy control comparison groups (Harvey et al., 2005).

To our knowledge, there are currently no studies which examine the relationship between subjective and objective sleep variables directly in symptomatic BD patients. Given the significant relationship between sleep disturbance and bipolar disorder, there is considerable clinical benefit to understanding the capability of bipolar patients to accurately record and report sleep quantity. The current study evaluated the relationship between subjective and objective sleep measurements in a BD I population. We also assessed the role of mood state and symptom severity on the impact of the relationship between subjective and objective measures of sleep in BD subjects.

2. Methods

The primary aim of the study was to assess the correlation between subjective assessment of total sleep time as reported by sleep diaries and the objective assessment of total sleep time as recorded via actigraphy in patients with bipolar disorder. Exploratory study aims examined the influence of mood state on any discrepancies between subjective and objective assessments of total sleep time. We hypothesized that there would be a general discrepancy between the objective and subjective measurements of sleep and that the severity of mood symptomotology would be associated with this discrepancy. Specifically, we hypothesized that there would be an overestimation of sleep with symptoms of mania and an underestimation of sleep duration with depressive symptoms.

2.1. Subjects

39 BD I subjects were included in our evaluation. All subjects were participating in a study examining the associations between circadian gene polymorphisms and clinical and course of illness characteristics in BD I subjects at the University of Texas Southwestern Medical Center at Dallas (UTSW). Subjects were recruited from various sources throughout Dallas County and represented a broad sampling of subjects diagnosed with the illness. Patients were recruited from county and community hospitals, the university medical center, community mental health clinics, and psychiatric and clinical research groups at UTSW. Chronobiologically based intermediate phenotype assessments were the focal point of the parent study and, therefore, subjects with a history of shift work or diurnal changes in work schedule four weeks prior to or during the course of the study, travel involving three or more time zones occurring four weeks prior to or during the course of the study, current use of hypnotic agents for sleep, neurological impairment (i.e., history of cerebrovascular accident), decompensated medical illness, mental retardation, traumatic brain injury, and a recent history of substance abuse or dependence were excluded from the study.

2.2. Procedure

The study was approved by the institutional review board of UTSW Medical Center and was consistent with standard for the ethical conduct of human research. All study participants provided written informed consent. This observational study was conducted under ambulatory (at home) conditions. Subjects arrived at the research laboratory to be fitted with the actigraph device and received instruction on how to complete sleep diaries. Subjects wore the actigraph device on their non-dominant wrist for a period of seven continuous days, while maintaining a sleep diary for the same duration of time. Once subjects completed the week of data collection they returned to the research laboratory where a trained clinician administered clinical assessments to assess symptom severity.

Table 1
Demographic and clinical characteristics of the patient sample.

$n=39$	Mean
Demographic variables	
Caucasian (%)	64.1
Hispanic (%)	5.1
African American (%)	30.8
Female (%)	64.1
Age (mean ± SD)	40.8 ± 11.1
Clinical variables	
YMRS (mean ± SD)	14.21 ± 8.2
IDS-30-C (mean ± SD)	20.51 ± 12.3
Age at first symptoms (mean ± SD)	16.9 ± 8.7
History of psychiatric hospitalization (%)	69.2
Number of hospitalizations (mean ± SD)	4.2 ± 6.9
History of suicide attempt (%)	51.3
History of psychosis (%)	69.2

2.3. Clinical assessments

DSM-IV Axis I diagnosis of BD I was confirmed by the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I/P). All cases were then subject to a best estimate diagnostic consensus including a minimum of three experienced clinicians in order to confirm the diagnosis of BD I. The Young Mania Rating Scale (YMRS) was used to determine the severity of manic symptoms while the 30-item inventory of depressive symptoms clinician rating scale (IDS-30-C) was used to determine the severity of depressive symptoms. Symptom rating scales were collected at termination of actiwatch period to assess mood and symptom severity for the study period.

2.4. Subjective and objective sleep measure

While some subjects had multiple sleep episodes throughout a single 24 h period, only primary sleep episodes as defined by subject's record in their sleep diary determined subjective total sleep time (TST). The primary sleep episode reported by the subject was typically the one nocturnal sleep period in a 24-h time frame. Self-reported sleep diaries were used record participants sleeping and waking times and functioned as the primary subjective sleep measure. Actigraphy was used to collect data concerning physical activity and an objective sleep measure. Basic Motionlogger actigraph units (Ambulatory Monitoring, Inc., Ardsley, NY) were utilized with data sampled in 60 s epochs. Total sleep time (TST) as recorded by actigraphy and calculated via the UCSD sleep algorithm was used as the objective sleep measure in the study.

2.5. Statistical analysis

Differences between subjective and objective measures of sleep were calculated by the objective time measured minus the subjective time reported. Pearson's test was conducted to test the correlation between subjective and objective measures of TST. Multivariate regression analysis was conducted to test the impact that mood state had on discrepancy between subjective and objective estimates of TST. A significance value of 0.05 was set for all statistical tests.