Sleep Medicine Reviews 33 (2017) 58–69

Contents lists available at ScienceDirect

Sleep Medicine Reviews

journal homepage: www.elsevier.com/locate/smrv

CLINICAL REVIEW

Actigraphic features of bipolar disorder: A systematic review and meta-analysis

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ARTICLE INFO

Article history:
Received 31 August 2015
Received in revised form
18 May 2016
Accepted 19 May 2016
Available online 27 May 2016

Keywords:
Bipolar disorders
Actigraphy
Adult
Sleep disorders
Meta-analysis

SUMMARY

Sleep disruptions represent a core feature of bipolar disorders and have been widely studied through the use of actigraphy, which is an objective measure of motor activity and sleep. Finding objective outcomes, which reliably measure sleep in bipolar disorders, is essential in developing better therapies and improving follow-up monitoring strategies. Our aim is to understand the role of actigraphy as an objective measure of sleep in bipolar disorder.

We undertook a systematic review and meta-analysis on studies using actigraphy to detect changes in activity and sleep patterns in bipolar patients versus healthy controls. The primary outcome measures were the analyses of 'activity mean' and 'sleep duration'. As secondary outcomes we analysed 'sleep onset latency', 'sleep efficiency', and 'time awake after sleep onset'.

Thirteen studies comprising 821 subjects met quality criteria for inclusion. The results show a decrease in activity mean and an altered pattern of sleep in bipolar patients. Further analyses suggest that the results might be generalized to a bipolar condition which underlies manic and depressed episodes as well as euthymic phases.

This study highlights the role of actigraphy as an important objective tool for the ambulatory monitoring of sleep and activity in bipolar disorders.

Introduction

Bipolar disorder (BD) is a disorder of mood with an approximately 1% population lifetime prevalence [1]. It has an even gender distribution and high heritability [2]. Over the last few years, the personal, family, societal and economic impacts of mental illness have been evaluated more completely. It is clear that there is a substantial cost in the provision of mental health services and a loss to the economy owing to mental illness. In-patient costs are considerable, given the time spent in hospital by patients who are either manic and responding poorly to treatment or depressed and suicidal [3].

In BD, clinical symptoms include formal thought disorder (with pressure of speech and flight of ideas), grandiosity (which can be delusional), motor over-activity, and sleep disturbance. Bipolar disorder involves an increased likelihood of depressive mood episodes with somatic symptoms such as appetite or sleep variation, motor excitation or retardation, cognitive features of nihilistic thinking and psychomotor slowing. In severe cases of bipolar depression, psychotic symptoms may be present such as auditory hallucinations, hypochondriacal delusions and delusions of guilt [4]. Features of elevated mood may include disinhibition or recklessness and overspending, while depressive features often include a poor sense of self-worth and possible suicidality.

Bipolar management may include pharmacological and non-pharmacological approaches or a combination. Evidence based treatment options are summarised in guidelines, such as those

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http://dx.doi.org/10.1016/j.smrv.2016.05.003
1087-0792/

Glossary of terms

ASRM	Altman self-rating mania scale
BAP	British association of psychopharmacology
BD	bipolar disorder
BDI	Beck depression inventory
CI	confidence interval
DSM-IV-TR	diagnostic and statistical manual of mental disorders IV edition, text revised
HC	healthy controls
HDRS	Hamilton depression rating scale
ICD-9	International classification of diseases 9th edition
IDS-C	inventory of depressive symptomatology clinician-rated
IV	inverse variance method
MADRS	Montgomery-Asberg depression rating scale
MAS	mania rating scale
NHS	UK National Health Service
NICE	National institute for health and clinical excellence
NOS	Newcastle–Ottawa scale
PSG	polysomnography
QIDS-C	quick inventory of depressive symptomatology clinician-rated
QIDS-SR	quick inventory of depressive symptomatology self-report
SD	standard deviation
SMD	standardized mean differences
YMRS	Young mania rating scale

published by the british association of psychopharmacology (BAP) [5] and the national institute for health and clinical excellence (NICE) [6]. There are various pharmacological options for the treatment of acute episodes and for relapse prevention. Acute phase medication typically involves an anti-psychotic drug alongside benzodiazepines for elevated mood (mania or hypomania) and anti-depressants in conjunction with mood stabilisers for depression [7]. Current mood stabilising options include lithium, which reduces relapse rates by 30–40% [8], but has a number of side effects found unpleasant by patients and carries medical risks if not carefully monitored [9]. Other mood stabilisers include sodium valproate, carbamazepine, lamotrigine -which is found most useful in patients with a tendency towards depressive episodes-, and gabapentin [10]. Non-medication options include family-focused psycho-education [7], cognitive behavioural therapy, which has not consistently been found to be beneficial [11,12], and interpersonal and social rhythm therapy [13,14].

Present methods available to assess mood are limited, including a number of rating scales, which are either clinician completed or self-reported. These include the Young mania rating scale (YMRS) [15] and the clinician-rated, quick inventory of depressive symptomatology for clinician completion (QIDS-C) [16], the Hamilton depression rating scale (HDRS) [17] and the Montgomery–Åsberg depression rating scale (MADRS) [18]. Self-report scales include the Altman self-rating mania scale (ASRM) [19], the quick inventory of depressive symptomatology self-report for patients (QIDS-SR) [16] and the Beck depression inventory (BDI) [20]. Other options to assess mood include asking the patient to record their mood in a diary, as done by cognitive based therapists. Alongside mood diaries, sleep diaries may be used. This is important as sleep disturbances may precipitate mood episodes [21]. However, sleep diaries are not as reliable as actigraphy in detecting sleep variations as they are subject to recollection bias. Conversely, actigraphy is an objective, non-invasive method for recording motor activity and sleep parameters over extended periods. Measurements are captured through an accelerometer-based device worn, in most cases, on the non-dominant wrist. In recent years actigraphy has emerged as a major assessment tool, proving to be valid [22], reliable [23] and cost-effective [24]. Sleep in BD has been investigated using sophisticated methodologies e.g., polysomnography (PSG) [25]; however attempts to find physical biomarkers of the disorder have been limited in their success. We have previously highlighted the importance of actigraphy as a measure for monitoring sleep and activity in individuals with ADHD [27,28] and a recent review has synthesized studies that employed different sleep-wake outcomes (i.e., sleep diary, actigraphy, polysomnography, and questionnaires) in individuals with high risk of developing bipolar disorder or inter-episode bipolar disorder versus normal controls and/or people with primary insomnia [29]. With actigraphy, despite certain limitations, an indirect estimation of sleep-wake states may be recorded. There is an expectation that through actigraphy one may achieve an objective measurement of sleep and activity concurrently, over extended periods of time. An objective measurement would be especially useful towards tracking changes in the natural environment across the multiple phases of BD. Benefits of finding such a system would be manifold:

a) facilitating assessment of the effectiveness of new compounds for the treatment of BD.
b) monitoring clinical progress by technological means. This is already done to some extent and one example is “True Colours” [26] a clinical service rolled out in Oxfordshire and Buckinghamshire (UK). In “True Colours”, patients use summarised symptom scores and submit information through text messaging, following an automated reminder.
c) introducing an early warning system of imminent mood relapses. Presently, this aspect is in its infancy and is not known to be better than clinical or family observation.

In view of the above, it is necessary and increasingly relevant to the investigation and management of bipolar disorder, to pool together actigraphic data on activity mean and sleep parameters in individuals with BD, in order to most appropriately and scientifically utilise these parameters.

Objective

Our article aims to assess differences, in terms of actigraphic parameters, in studies comparing individuals with BD versus healthy controls.

Methods

Literature search

A literature search of the PubMed/MEDLINE, Cochrane Library, CINAHL, Scopus and PsycINFO databases was carried out to find relevant peer reviewed articles on actigraphy in bipolar disorder. A