Practice Parameters for the Use of Actigraphy in the Clinical Assessment of Sleep Disorders

An American Sleep Disorders Association Report
Standards of Practice Committee of the American Sleep Disorders Association

Michael Thorpy, MD[1], Andrew Chesson, MD[2], Sarkis Derderian, DO[3], Gihan Kader, MD[4], Richard Millman, MD[5], Samuel Potolicchio, Jr., MD[6], Gerald Rosen, MD[7], Patrick J. Strollo, Jr., MD[8]

[1]Sleep-Wake Disorders Center, Montefiore Medical Center, Bronx, NY, [2]LSUMC Sleep Disorders Center, Shreveport, LA, [3]Sleep Disorders Respiratory Research Laboratory, Walter Reed Army Medical Center, Washington, DC, [4]HCA-Wesley Neurodiagnostics and Sleep Disorders Center, Wichita, KS, [5]Sleep Disorders Center, Rhode Island Hospital, Providence, RI, [6]Georgetown University Sleep Disorders Center, Washington, DC, [7] Sleep Disorders Center, Hennepin County Medical Center, Minneapolis, MN, [8]Pulmonary Sleep Evaluation Center, Pittsburgh, PA

Summary: These clinical guidelines, which have been reviewed and approved by the Board of Directors of the American Sleep Disorders Association, provide recommendations for the practice of sleep medicine in North America for the use of actigraphy in the clinical assessment of sleep disorders. The American Sleep Disorders Association has produced these guidelines, based upon a critical review of the scientific literature, regarding the use of actigraphy in the clinical evaluation of sleep disorders. Though not indicated for the routine assessment of sleep disorders, actigraphy may be a useful adjunct, in certain circumstances, to a detailed history and examination when demonstration of multiday rest-activity patterns is necessary to diagnose, document severity, and guide proper treatment of sleep disorders.

Key Words: Actigraphy; Insomnia; Movement; Physiologic monitoring; Practice guidelines; Sleep; Sleep disorders.

[This position paper is referenced by the square-bracketed numbers to the numbered sections in the accompanying review.]

Actigraphy, which consists of a small portable device that senses physical motion and stores the resulting information, has been widely used in research studies for the evaluation of rest-activity cycles. Researchers have used this device to measure sleep disturbances reflective of a variety of clinical sleep disorders, including the insomnias, the obstructive sleep apnea syndrome, and periodic limb movement disorder. Actigraphy is generally accepted as a useful research device; the role of actigraphy in the clinical evaluation of sleep disorders is, however, less clear.

Based upon a critical review of the scientific literature, this practice-parameters paper presents recommendations regarding the use of actigraphy in the clinical assessment of sleep disorders.

METHODS

The Standards of Practice Committee of the American Sleep Disorders Association formed a task force to review the role of actigraphy in the diagnosis, assessment, and management of clinical sleep disorders [(1)]. Based on the accompanying review and on consultation with other specialists and interested parties, the subsequent recommendations were developed by the Standards of Practice Committee and approved by the American Sleep Disorders Association's Board of Directors. Wherever possible, the conclusions are evidence based; however, in those circumstances where the scientific data are absent, insufficient or inconclusive, recommendations are based on consensus opinion. All members of the American Sleep Disorders Association's Standards of Practice Committee and Board of Directors completed detailed conflict of interest statements and were found to have no conflicts of interest with regard to this topic.

These guidelines should not be considered inclusive of all proper methods of care or exclusive of other methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding the propriety of any specific care must be made by the clinician in light of the individual circumstances presented by the patient and the availability of diagnostic and treatment options and resources.

The American Sleep Disorders Association expects these guidelines to have an impact on professional behavior, patient outcomes and, possibly, healthcare costs. These practice parameters reflect the state of knowledge at publication and will be reviewed, updated, and revised as new information becomes available.

BACKGROUND

Actigraphs used for the clinical and research evaluation of sleep disorders are mechanical or digital devices that generate an internal signal each time they are moved (accelerated). These signals are processed on-line with frequent (typically every 0.1 second) sampling that usually occurs over many days. The stored movement data may be transferred to a computer for display, scoring, interpretation, and conversion into sleep parameters.

Recordings can be conducted for days or weeks on patients in their own homes under conditions more natural and typical than can be achieved by polysomnography (PSG) in the sleep laboratory. Actigraphy allows a patient's rest-activity cycle to be studied for many days and nights with minimal disturbance, and the number of nights of recording can be extended with little increase in cost. Even though actigraphy is less intrusive and less expensive than PSG, the findings from these two objective tests do not usually add to the diagnosis of insomnia in most patients. The diagnosis of insomnia is best determined by obtaining an accurate and thorough history.

Actigraphy may help clarify the severity of insomnia but will not explain the etiology of insomnia, except insofar as symptoms may be misstated or when symptoms are related to the timing of sleep. The accuracy of actigraphic measurements in insomniacs is considerably worse than it is in good sleepers. Compared to sleep logs, actigraphy provides a more accurate assessment of the sleep-wake patterns of patients with insomnias associated with mental disorders, sleep-state misperception and, at times, psychophysiologic insomnia. Again compared to sleep logs, actigraphy provides a less accurate assessment of the sleep-wake patterns of patients with body-movement disorders or who lie awake in bed for prolonged periods of time.

The optimal assessment of circadian-rhythm sleep disorders requires the examination of patients' sleep-wake cycles for prolonged periods of time. Even if absolute values of actigraphy such as sleep efficiency and total sleep time are imprecise, trends may be accurately reflected. Actigraphy is not indicated as a primary diagnostic tool but, for the study of excessive somnolence, may be a useful adjunct to standard polysomnographic and multiple-sleep-latency testing to confirm reported patterns of rest and activity and even to identify contributing circadian - related factors.

The major limitation of actigraphy is its lack of precision. Body movements, the one parameter recorded by actigraphy, only indirectly reflect measures of sleep and cardiorespiratory function. The accurate recognition of specific patterns associated with sleep apnea remains too low for clinical application. Actigraphy may provide inaccurate data when used to assess the rest-activity cycles of patients who lie still for long periods while still awake or who have movement disorders. These conditions include both non-sleep-associated disorders, such as Parkinson's disease, and sleep-associated disorders, such as restless legs syndrome, and periodic limb movement disorder.

Although researchers have used actigraphy to collect data about sleep in various clinical settings, most of their studies were conducted without polysomnographic validation. The validation studies that have compared actigraphy with PSG were conducted using various devices, differently chosen patient populations, and assorted (manual and automatic) scoring algorithms. These validation studies have a bias to external validity in that they were performed in the sleep laboratory and not in actigraphy's environment of intended use, i.e. the patient's natural setting.

Actigraphy, as a measure of sleep, is most accurate when used to differentiate major periods of sleep and waking. Actigraphy cannot reliably differentiate between rapid-eye-movement sleep stages and nonrapid-eye-movement sleep stages. Short periods of sleep and wakefulness are much more difficult to recognize actigraphically than are long ones. The sleep parameters most closely estimated by actigraphy are sleep duration, sleep efficiency, and waking after sleep onset. Even these parameters are difficult to assess, however, because they are very sensitive to individual differences in sleep and movement patterns. Depending upon these individual characteristics and patients' specific clinical problems, the correlation of actigraphically determined sleep parameters with actual sleep measurements may vary from good to poor. Sleep latency is more difficult to estimate.

RECOMMENDATIONS

Clinical applications

1. Actigraphy is not indicated for the *routine* diagnosis, assessment of severity, or management of any of the sleep disorders, including the insomnias, obstructive sleep apnea syndrome and periodic limb movement disorder [5.0-5.1.4].

2. Actigraphy may be a useful adjunct to a detailed history, examination, and subjective sleep diary for the diagnosis and treatment of insomnia, circadian-rhythm disorders, and excessive sleepiness: a) When demonstration of multiday rest-activity patterns is necessary to diagnose, document severity and guide the proper treatment [4.2,4.5,5.1-5.1.4]. b) When more objective information regarding the day-to-day timing, amount or patterns of a patient's sleep is needed for optimal clinical decision-mak-

ing [5.1.2,5.1.3,5.3-5.3.3]. c) When the severity of a sleep disturbance reported by the patient or caretaker seems inconsistent with clinical impressions or laboratory findings. d) To clarify the effects of, and (under some instances) compliance with, pharmacologic, behavioral, phototherapeutic or chronotherapeutic treatment [5.1.1-5.1.4,5.3-5.3.3]. e) In symptomatic patients for whom an accurate history cannot be obtained and in whom polysomnographic study has already been conducted, or is considered unlikely to be of much diagnostic benefit, or is not yet clearly indicated (because of the absence of accurate historical data) or is not immediately available.

3. Actigraphy may be a useful adjunct to modified portable sleep-apnea testing when determining the rest-activity pattern during the testing period.

4. Actigraphy is an effective means of demonstrating multiday human rest-activity patterns and may be used to estimate sleep-wake patterns in the occasional clinical situations where a sleep log or diary cannot provide similar information.

Technical considerations

1. Actigraphic studies should be conducted for a minimum of three consecutive 24-hour periods.

2. Inspection of raw data is not necessary; some preprocessing of movement counts is acceptable, but epoch lengths should be limited to a maximum of 1 minute.

3. Interpretation must be done manually by visual inspection following procedures outlined, and algorithms validated for, the specific device in use. Automatic scoring may be used in addition to manual methods of scoring.

Consultants: Alejandro Chediak, MD, Alan Douglass, MD, Richard Ferber, MD, Martin Reite, MD, and Virgil Wooten, MD.

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