

Fatores cronobiológicos relacionados aos horários de dormir e acordar em pacientes com acidente vascular cerebral

Chronobiological factors related to sleep and wake schedules of patients with stroke

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Resumo

Introdução: O Acidente Vascular Cerebral (AVC) representa uma doença de alta mortalidade e de maior causa de incapacidade em adultos no Brasil. Além de distúrbios cognitivos e deficits motores, essa doença da Parte Central do Sistema Nervoso leva o paciente a apresentar alterações do sono. **Objetivos:** Este estudo avaliou os fatores cronobiológicos associados aos horários de dormir e acordar de pacientes com Acidente Vascular Cerebral. **Casística e Métodos:** Participaram 50 pacientes (28 homens). Durante uma semana, os indivíduos preencheram um diário de sono, o *Social Rhythm Metric* (SRM), o *Activity Level Index* (ALI) e o Questionário de Matutividade e Vespertinidade (QMV). Na análise dos dados foi utilizado o teste de correlação de Spearman. **Resultados:** Foi encontrada uma correlação significativa entre os horários de dormir e acordar com o cronotipo e entre a hora de dormir e o *Social Rhythm Metric*, e a hora de acordar e o *Activity Level Index*. **Conclusão:** Os resultados indicam a necessidade de se avaliar o cronotipo dos pacientes durante o processo terapêutico e promover atividades que possam estimular o ritmo social, a fim de contribuir com a melhoria do padrão do sono dos pacientes.

Descritores: Acidente vascular cerebral; Sono; Atividades cotidianas; Fenômenos cronobiológicos.

Abstract

Introduction: The Stroke is a disease of high mortality and the leading cause of disability among adults in Brazil. In addition to the cognitive deficits and motor disorders, this disease of the Central Nervous System can provide sleep disturbances. **Objective:** This study evaluated factors associated with sleep and wake schedules of patients with stroke. **Patients and Methods:** The study population included 50 patients (28 men). The patients completed a daily sleep, Social Rhythm Metric (SRM), Activity Level Index (ALI) and Morningness-Eveningness Questionnaire (MEQ). Data were compared using the Spearman correlation test. **Results:** We found a significant correlation between sleep and wake up times with chronotype, and between Social Rhythm Metric and bedtime, and wake-up time and the Activity Level Index. **Conclusion:** The results indicate the need to assess chronotype of patients during the therapeutic process and promote activities, which encourage social rhythm and contribute to the improvement of sleep patterns of patients.

Descriptors: Stroke; Sleep; Activities of daily living; Chronobiology phenomena.

Introduction

Interest has grown around the greater importance of Stroke as a global health problem. Besides the increased mortality rate, it is the leading cause of disability in adults, generating a high expense for health systems⁽¹⁾. Suffering a stroke reflects the imbalance of physical, social, and psychological functioning. After the stroke, the person has motor and cognitive deficits, and functional. The person needs help to perform activities of

daily living. It also demands greater family support and the use of the health system and other social institutions⁽²⁻³⁾.

The literature shows that stroke patients besides having sensorimotor and cognitive deficits, they may also have sleep disorders⁽⁴⁻⁵⁾. However, it is still necessary to evaluate how these disorders occur. The neurotransmitters may be involved in these disorders⁽⁶⁾. Nevertheless, there is also evidence that systems

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which regulate sleep, circadian, and homeostatic can undergo change⁽⁷⁻⁸⁾. The homeostatic process is responsible for the increased propensity toward sleep during wake times and a decrease propensity during sleep times. The circadian process promotes the temporal organization of the sleep-wake cycle and through alert mechanisms maintains wakefulness during the day, thus facilitating sleep consolidation at night, as assessed by chronobiology⁽⁷⁾. The study of patients with subcortical stroke and compromised hypothalamus suggests a functional interruption of the suprachiasmatic nucleus. It affects the promotion of wakefulness in the circadian process, causing alterations in alertness, expressed mainly by diurnal somnolence in the patients⁽⁸⁾.

It is possible that other factors may be related to the sleep disorders of individuals such as the chronotype and social rhythm. Regarding chronotype, individuals can be classified into the “morning type”; “evening type,” and “intermediate type.” The “morning type” individuals are those who prefer to sleep and wake up early. They keep a good level of alertness and performance activities during the morning. The “evening type” individuals are those who tend to sleep and wake up late. They show a better performance in activities during the afternoon or in the evening. The “intermediate type” individuals are those who had no specific preference⁽⁹⁾. As for the social rhythm, this occurs when the timing of activities of daily living such as getting out of bed, have breakfast, lunch, working, among others, are regular. This means these activities are performed at a frequency of three or more times per week with very similar schedules, expressing a rhythm that influences the circadian system of the individual. This is measured by the Social Rhythm Metric (SRM) and the Activity Level Index (ALI)⁽¹⁰⁾. Therefore, the recognition by health professionals of the occurrence of sleep problems related to chronotype, SRM, and ALI can be an important component in the clinical approach in general.

Depending on the literature data, the study aimed to assess chronobiology factors associated with sleep and wake schedules of patients with stroke in order to discuss the implications for clinical practice these patients.

Patients and Methods

The study included 50 patients with stroke, of both sexes, recruited from the Department of Physical Therapy. The exclusion criteria for patients were: recurrent brain injury, severe cognitive disorders and aphasia.

The study was approved by the local Research and Ethics Committee according to the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000). The participants were informed about the research procedures, and Written Informed Consent was obtained from each patient. We assured that the confidentiality, security, and integrity of data and information will be maintained. We interviewed each patient and gathered the following information: identification, age, time of injury and diagnosis of stroke (using computed tomography).

For one week, subjects completed a daily sleep in their homes, recording times of sleeping and waking. In the same week, we also recorded the time they performed 17 activities each day:

Get out of bed, First contact with another person, Morning beverage, Breakfast, Go outside, Start work, housework or volunteer activities, Lunch, Afternoon nap, Have dinner, Exercise, Evening snack or drink, TV news, Other TV program, Activity A, Activity B, Return home last time, and Go to bed. The SRM scores range from 0 to 7 (from lower to higher regularity). Through SRM, we calculate the ALI, which means the amount of activities that are performed regularly⁽¹⁰⁾. When a particular activity occurred three or more times a week, followed by a regular time within 45 minutes, it was considered a hit. The hit of each activity can range from zero to whatever number of days the instrument is repeated. In regard to the ALI score, 199 would be considered a maximum value in case all 17 activities of the instrument are performed regularly and for a 7-day period. The hit and the ALI values are used to calculate the SRM.

The Questionnaire of chronotype (Morningness/Eveningness Questionnaire (MEQ) was applied. The scores from 16 to 41 determined the “evening type,” individual; between 59 and 86 defined the “morning type” individuals, and between 42 and 58 the “intermediate type” individuals⁽⁹⁾.

The statistical software SPSS (SPS, version 15.0, Chicago, IL) was used for all tests. For these tests, a P value of 0.05 was considered as statistically significant. We applied the Spearman correlation test to check the correlations between sociodemographic and clinical characteristics, chronotype, social rhythm and Activity Level Index (ALI) with the sleep-wake schedules.

Results

The final pool of patients comprised 50 participants, 22 women and 28 men. Regarding schooling, 26% of the participants were illiterate and 74% were educated; 46% of the participants had left brain damage, and 54% had right brain damage.

Table 1 shows the sociodemographic and clinical characteristics, chronotype, and social rhythm, as well as the hours of sleep and wake up. The sample showed only the “intermediate type” individuals. We could not find the “morning type” and the “evening type” individuals.

Table 1. Descriptive analysis of sociodemographic and clinical characteristics, chronotype, social rhythm, Activity Level Index and sleep and wake up times of patients with stroke.

Variables	Minimum	Median	Maximum
Bed time (hh: mm)	19:00	21:22	24:20
Time to wake up (hh: mm)	05:00	06:20	10:30
Age (years)	25	63	90
Period of sequel (months)	1	10	60
MEQ (scores)	43	66	84
SRM (scores)	2.8	5	7
ALI (scores)	28	53	100

MEQ= Morningness/Eveningness Questionnaire; SRM= Social Rhythm Metric; ALI= Activity Level Index.

Correlation analysis identified a relevant correlation between sleep and wake schedules with chronotype (MEQ). In addition, there was significant correlation between SRM and bedtime, and wake-up time and ALI (Table 2).

Table 2. Correlation coefficients and *P*-values of Spearman's correlation analysis between the times of sleeping and waking and the sociodemographic, clinical, chronotype, social rhythm, and Activity Level Index of patients with stroke.

Variables	Sleeping		Waking	
	R	P	R	P
Sex	-0.05	0.735	-0.25	0.079
Age	-0.17	0.239	0.09	0.528
Schooling	-0.08	0.576	-0.14	0.337
Time lesion	-0.17	0.227	-0.05	0.709
Affected side	-0.12	0.401	0.18	0.204
MEQ	-0.44	0.002	-0.28	0.047
SRM	-0.32	0.024	-0.20	0.168
ALI	-0.16	0.277	-0.32	0.025

MEQ= Morningness/Eveningness Questionnaire; SRM= Social Rhythm Metric; ALI= Activity Level Index.

Discussion

The development of studies in the area of sleep disorders after stroke has contributed heavily as a guideline for the advancement of knowledge in multidisciplinary action⁽¹¹⁻¹³⁾.

The study sample included 50 patients with sequelae of stroke. Of those, more than half were men. A high prevalence of male patients with this neurological disease corroborates the literature⁽¹⁾. This can be justified by the fact that women are more aware and have more access to health services, thereby reducing the risk to develop diseases. Regarding the affected side, we noted that the right side was the most affected one. However, the literature showed frequency variations, without determining a predominance of one of the cerebral hemispheres⁽¹⁴⁾.

Regarding chronotype, the study showed that we could not find intermediate, morning, and evening individuals. Nevertheless, we could observe a significant correlation between sleep and wake schedules with chronotype. In general, studies indicate that morning and evening individuals have higher performance when tasks are executed at their corresponding specific chronotype. According to the literature, there is an association between the cognitive-motor performance and the circadian rhythm. It shows that performance is better when the tests are conducted in best period of peak activity/performance of the circadian cycle, and it is worse when the tests are applied in more lethargic and run-down period of peak activity of the circadian cycle⁽¹⁵⁻¹⁶⁾. The professionals can underestimate or overestimate the cognitive and motor performances depending on the time of testing in

clinical practice. In the present study, the correlation observed suggests the need to assess chronotype patients during the therapeutic process in order to promote activities organized temporally in accordance with the preferred schedule of patients, which encourage social rhythm and contribute to the improvement of sleep patterns of patients.

As the correlations with SRM and ALI, these may have occurred because the motor and functional sequelae of stroke patients who generate difficulties in daily activities, becoming dependent according to disease severity. Moreover, the occurrence of stroke causes a great emotional impact affecting self-esteem, personal and social relations, which can cause an individual to have a normal participation in society⁽²⁻³⁾. Thus, there may be either a change in the regularity of activities as a decrease in the number of habitual activities. Other authors⁽¹³⁾ found that low level of activity was significantly correlated with low amplitude of the sleep-wake cycle in patients with stroke. Thus, the motor rehabilitation may be of fundamental importance to increase the activity level of these patients and stimulate the circadian timing system.

In a previous study⁽¹²⁾, the SRM was correlated with the degree of neurological impairment and the ALI was associated with functional impairment, suggesting that these measures may be used as markers of neurological outcome and functionality of stroke patients.

The present study had some limitations. In this study, the relationship between sleep time and location of specific brain lesions was not evaluated because the neuroimaging studies have been conducted in different hospitals, not allowing the standardization of medical reports. Furthermore, it was important to analyze the influence of the circadian system in the regulation of sleep in these patients.

Conclusion

We found significant correlation of sleeping and waking time with chronotype. Another significant finding was the association of the wake-up time with the ALI and bed time with the SRM, suggesting that Neurorehabilitation should be planned after a review of the individual different functions, such as physical, cognitive, psychological, social, and sleep. It is of vital importance that therapeutic interventions may be directed to the quality of life of these patients through programs of regular physical and social activities.

References

1. Appelros P, Stegmayr B, Terént A. Sex differences in stroke epidemiology: a systematic review. *Stroke*. 2009;40(4):1082-90. doi: 10.1161/STROKEAHA.108.540781.
2. Nichols-Larsen DS, Clark PC, Zerinque A, Greenspan A, Blanton S. Factors influencing stroke survivors' quality of life during subacute recovery. *Stroke*. 2005;36(7):1480-4.
3. Scalha TB, Miyasaki E, Lima NM, Borges G. Correlations between motor and sensory functions in upper limb chronic hemiparetics after stroke. *Arq Neuropsiquiatr*. 2011;69(4):624-9.
4. Schuiling WJ, Rinkel GJ, Walchenbach R, Weerd AW. Disorders of sleep and wake in patients after subarachnoid

- hemorrhage. *Stroke*. 2005;36(3):578-82.
5. Rocha PC, Barroso MTM, Dantas AATSG, Melo LP, Campos TF. Predictive factors of subjective sleep quality and insomnia complaint in patients with stroke: implications for clinical practice. *An Acad Bras Cienc*. 2013;85(3):1197-206.
 6. Schulz P, Steimer T. Neurobiology of circadian systems. *CNS Drugs*. 2009;23(Suppl 2):3-13.
 7. Borbély AA, Achermann P. Sleep homeostasis and models of sleep regulation. *J Biol Rhythms*. 1999~14(6):557-68.
 8. Bliwise DL, Rye DB, Dihenia B, Gurecki P. Greater daytime sleepiness in subcortical stroke relative to Parkinson's disease and Alzheimer's disease. *J Geriatr Psychiatry Neurol*. 2002~15(2):61-7.
 9. Horne JA, Östberg O. A self-assessment questionnaire to determine morningness-eveningness, in human circadian rhythms. *Int J Chronobiol*. 1976;4(2):97-110.
 10. Monk TH, Flaherty JF, Frank E, Hoskinson K, Kupfer DJ. The Social Rhythm Metric: an instrument to quantify the daily rhythms of life. *J Nerv Ment Dis*. 1990;178(2):120-6.
 11. Campos TF, Pinheiro CDG, Diógenes FP, Barroso MTM, Dantas AATSG. Cronotipo e implicações para sua utilização na fisioterapia em pacientes com acidente vascular encefálico. *Fisioter Pesqui*. 2011;18(3):258-63.
 12. Campos TF, Galvão Silveira AB, Miranda Barroso MT. Regularity of daily activities in stroke. *Chronobiol Int*. 2008;25(4):611-24. doi: 10.1080/07420520802247530.
 13. Cavalcanti P, Campos T, Araújo J. Actigraphic analysis of the sleep-wake cycle and physical activity level in patients with stroke: implications for clinical practice. *Chronobiol Int*. 2012;29(9):1267-72. doi: 10.3109/07420528.2012.719960.
 14. Strong K, Mathers C, Bonita R. Preventing stroke: saving lives around the world. *Lancet Neurol*. 2007;6(2):182-7.
 15. Rowe G, Hasher L, Turcotte T. Age and synchrony effects in visuospatial working memory. *Q J Exp Psychol (Hove)*. 2009;62(10):1873-80. doi: 10.1080/17470210902834852.
 16. Matchock RL, Mordkoff JT. Chronotype and time-of-day influences on the alerting, orienting, and executive components of attention. *Exp Brain Res*. 2009;192(2):189-98. doi: 10.1007/s00221-008-1567-6.

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