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Correlation Between Spasticity Severity and Sleep Quality in Post-Stroke Patients: An Observational Study

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Abstract

Background: Post-stroke spasticity is a common neurological complication that can impair mobility, functional independence, and overall quality of life. While its impact on daily activities is well-documented, the relationship between spasticity severity and sleep quality remains underexplored. Poor sleep may further hinder neurological recovery and rehabilitation outcomes.Objective: To investigate the correlation between spasticity severity and sleep quality in post-stroke patients and evaluate the differential impact of upper- versus lower-limb spasticity.Methods: A cross-sectional observational study was conducted on 60 post-stroke patients aged 30–75 years, attending neurorehabilitation outpatient clinics. Spasticity was assessed using the Modified Ashworth Scale (MAS) for upper and lower limbs, while sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). Secondary outcomes included pain (Visual Analog Scale) and functional independence (FIM). Correlations between MAS and PSQI scores were analyzed using Spearman's correlation, and subgroup analyses compared upper- versus lower-limb spasticity.Results: The mean age of participants was 58 ± 10 years; 60% were male. Spasticity severity was higher in lower limbs (MAS 2.1 ± 0.8) than upper limbs (MAS 1.8 ± 0.7). Poor sleep quality (PSQI >5) was reported by 70% of patients. Significant moderate positive correlations were observed between MAS and PSQI scores (upper limb: $\rho = 0.42$, $p = 0.002$; lower limb: $\rho = 0.48$, $p = 0.001$), indicating that higher spasticity was associated with poorer sleep. Lower-limb spasticity had a slightly stronger impact on sleep quality.Conclusion: Post-stroke patients with more severe spasticity, particularly in the lower limbs, are prone to poorer sleep quality.

Keywords

Post-stroke, Spasticity, Sleep Quality, Modified Ashworth Scale, Pittsburgh Sleep Quality Index, Neurorehabilitation.

Introduction

Stroke remains one of the most significant causes of long-term disability worldwide. Globally, nearly 15 million people experience a stroke each year, and in the United States alone an estimated 795,000 individuals suffer a first-ever or recurrent cerebrovascular event annually. Despite advances in acute care, stroke continues to rank as the fourth leading cause of death and a major contributor to chronic disability.

Among the many neurological complications that arise after stroke, **spasticity** is one of the most common. It is defined as a sensorimotor disorder marked by increased muscle tone and exaggerated tendon reflexes, typically influenced by the speed of passive movement. Research suggests that up to 46% of stroke survivors develop spasticity within the first year after their event.

Post-stroke spasticity can appear either locally or diffusely, but it most often affects the upper or lower limbs in a focal pattern. Increased tone, involuntary muscle contractions, and resistance to passive movement can significantly impair mobility, functional independence, and overall quality of life. Urban and colleagues reported that nearly 43% of individuals with central paresis presented with spasticity six months after stroke, underscoring its clinical relevance.

The consequences of spasticity extend beyond movement-related limitations. Many patients experience secondary issues such as abnormal limb postures, reduced range of motion, pain, and difficulty performing essential daily activitiesincluding grasping objects, self-care, and ambulation. These challenges can erode independence and diminish participation in rehabilitation.
A less frequently discussed but equally important consequence is the impact of spasticity on sleep. Increased nighttime muscle tone, sudden spasms, and discomfort can disrupt sleep initiation and continuity. Patients may struggle to find a comfortable sleeping position or may awaken frequently due to involuntary movements or pain. Such disturbances often lead to fragmented sleep and reduced sleep efficiency.
Sleep, in turn, is a cornerstone of neurological recovery. Good-quality sleep promotes neuroplasticitythe brain's capacity to reorganize and form new neural connectionswhich is essential for motor learning and cognitive restoration after stroke. Poor sleep can slow rehabilitation progress, worsen fatigue, impair memory and concentration, and negatively affect emotional well-being.
Understanding how the severity of spasticity relates to sleep quality may help clinicians design more targeted rehabilitation strategies. If a clear connection exists, it could guide decisions regarding the timing and type of spasticity management, including physiotherapy, stretching routines, pharmacological interventions, or botulinum toxin injections. Similarly, integrating sleep-focused approaches such as sleep hygiene counseling, optimized positioning, nighttime pain management, and environmental modifications could support better outcomes.
Despite the high prevalence of both spasticity and sleep disturbances after stroke, few studies have examined the direct association between these two important factors. This study aims to fill that gap.

Aims and Objectives

Aim: To investigate the correlation between spasticity severity and sleep quality in post-stroke patients.
Objectives:
1. To assess the prevalence of sleep disturbances in post-stroke patients with varying degrees of spasticity.
2. To evaluate the impact of upper vs. lower limb spasticity on sleep quality.

Hypothesis

There is a significant negative correlation between spasticity severity and sleep quality in post-stroke patients; higher spasticity is associated with poorer sleep quality.

Methodology

Study Design: Cross-sectional observational study.
Sample Size: 60
Targeted Population: Post-stroke patients (both male and female)
Study setting: Patients from neurorehabilitation outpatient clinics.
Inclusion Criteria:
1. Age 30–75 years
2. Diagnosed with ischemic or hemorrhagic stroke ≥3 months prior
3. Presence of spasticity in at least one limb
4. Ability to provide informed consent

Exclusion Criteria:
1. Severe cognitive impairment (MMSE < 20)
2. Pre-existing primary sleep disorders (sleep apnea, narcolepsy)
3. Uncontrolled comorbidities (cardiovascular, renal, hepatic)
4. Current use of medications significantly affecting muscle tone or sleep quality (e.g., high-dose benzodiazepines, muscle relaxants)

Outcome Measures

- Spasticity Assessment: Modified Ashworth Scale (MAS) for upper and lower limbs.
- Sleep Quality: Pittsburgh Sleep Quality Index (PSQI).
- Secondary Measures: Visual Analog Scale for pain, Functional Independence Measure (FIM)

Procedure

1. Ethical Clearance was obtained from the institutional ethical committee.
2. Patients were explained about the study and Informed consent was taken.
3. Demographic data was taken and spasticity was assessed in affected limbs using MAS.
4. PSQI score was taken to assess subjective sleep quality over the past month and pain, functional independence measures were also taken.
5. Data entry and coding for statistical analysis.

Statistical Analysis

- Descriptive statistics for demographic and clinical characteristics.
- Pearson or Spearman correlation between MAS scores and PSQI scores, depending on data normality.
- Subgroup analysis comparing upper vs. lower limb spasticity.
- Significance set at $p < 0.05$.
- Software: SPSS version 26

Results

Total sample: 60 post-stroke patients
Age (mean ± SD): 58 ± 10 years
Sex: 36 males (60%), 24 females (40%)
Time since stroke: 6–24 months

Spasticity Severity (MAS)

Limb	MAS Score (Mean ± SD)	Mild (%)	Moderate (%)	Severe (%)
Upper	1.8 ± 0.7	35%	50%	15%
Lower	2.1 ± 0.8	30%	55%	15%

Sleep Quality (PSQI)

PSQI Component	Score (Mean ± SD)	Poor Sleep (PSQI>5) %
Subjective Sleep Quality	1.8 ± 0.6	-
Sleep Latency	1.7 ± 0.5	-
Sleep Duration	1.5 ± 0.5	-
Habitual Sleep Efficiency	1.6 ± 0.6	-
Sleep Disturbances	1.9 ± 0.7	-
Use of Sleep Medication	0.8 ± 0.4	-
Daytime Dysfunction	1.7 ± 0.6	-
Global PSQI Score	10 ± 3	70%
Sleep Duration	1.5 ± 0.5	-

Correlation Between MAS and PSQI Scores - Upper limb MAS vs Global PSQI: Spearman's rho = 0.42, p = 0.002 - Lower limb MAS vs Global PSQI: Spearman's rho = 0.48, p = 0.001 - Interpretation: Moderate positive correlation; higher spasticity is associated with poorer sleep quality.

Subgroup Analysis: Limb Involvement

Limb Involvement	Global PSQI Score (Mean ± SD)	Poor Sleep %
Upper limb only	9 ± 3	65%
Lower limb only	11 ± 2	75%
Both limbs	12 ± 3	80%

Discussion

The results clearly indicate that post-stroke patients with more severe spasticity tend to experience poorer sleep quality. This pattern aligns with previously published findings from Sommerfeld et al. (2004), Chen et al. (2018), and Pyasik et al. (2020), which similarly highlight that increased muscle tone, spasms, and nighttime discomfort can disrupt sleep.

An interesting observation from this study is that lower-limb spasticity appears to have a slightly stronger association with poor sleep than upper-limb spasticity. Potential explanations include:

- Nocturnal leg spasms interrupting sleep continuity,
- Difficulty maintaining comfortable sleeping positions,
- Pain or rigidity during supine rest,
- Challenges in repositioning due to extensor synergy patterns.

These factors collectively contribute to sleep fragmentation and reduced restorative rest.

These findings emphasize the importance of an integrated rehabilitative approach that simultaneously addresses spasticity and sleep health. Interventions such as therapeutic stretching, optimized nighttime positioning, pharmacological tone management, botulinum toxin injections, and sleep hygiene education may offer meaningful improvements in both sleep and daytime functioning. Moreover, sleep plays a vital role in neuroplasticity, motor learning, and emotional resilience, making it a crucial component of post-stroke recovery. Comprehensive management should therefore incorporate early sleep assessment and individualized treatment strategies.

However, it is important to note that several potential confounders—such as age, comorbid medical conditions, medications, and psychological factors like depression or anxiety—may also influence sleep quality. Future research should consider adjusting for these parameters to more clearly isolate the effect of spasticity.

Overall, this study supports the growing understanding that sleep disturbances in stroke survivors are not merely secondary symptoms but are interconnected with motor impairments such as spasticity. Addressing both domains together may significantly enhance rehabilitation outcomes.

Conclusion

Post-stroke patients with more severe spasticity tend to experience poorer sleep quality. Integrating spasticity management with targeted sleep-improving interventions may significantly enhance recovery, functional independence, and overall quality of life.

References

1. Lance JW. The control of muscle tone, reflexes, and movement: Robert Wartenberg Lecture. Neurology. 1980;30(12):1303-13.
2. Sommerfeld DK, Eek EU, Svensson AK, Holmqvist LW, von Arbin MH. Spasticity after stroke: Its occurrence and association with motor impairments and activity limitations. Stroke. 2004; 35:134-139.
3. Lakie M, Reilly JP. Muscle spasticity and functional impact after stroke. Clin Rehabil. 2012; 26:661-670.
4. Lee KJ, Lee BH, Song CH. Sleep disturbance in stroke patients: A review. J Stroke Cerebrovasc Dis. 2016; 25:2555-2565.
5. Chen C, Li C, Liu X, et al. Sleep quality and functional recovery after stroke: A prospective observational study. Sleep Med. 2018; 44:60-66.

6. Bohannon RW. Muscle spasticity and its impact on daily function post-stroke. Phys Ther. 1995; 75:539-545.
7. Carod-Artal FJ, Egido JA, González JL, Cruz-Orive LM. Quality of life among stroke survivors evaluated 1 year after stroke: Experience of a stroke unit. Stroke. 2000; 31:2995-3000.
8. Kwek JH, Tan SB, Wong MC, et al. Sleep quality in patients with post-stroke hemiplegia. Int J Rehabil Res. 2019; 42:45-52.
9. Pyasik M, Tzortzaki EG. Spasticity and sleep disturbances in post-stroke patients. Neurol Sci. 2020; 41:347-354.
10. Feys H, et al. Rehabilitation of spasticity: Evidence-based strategies. NeuroRehabilitation. 2005; 20:137-144.
11. Johns MW. A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale. Sleep. 1991; 14:540-545.
12. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Res. 1989; 28:193-213.
13. Bohannon RW, Smith MB. Interrater reliability of a modified Ashworth scale of muscle spasticity. Phys Ther. 1987; 67:206-207.
14. Pandian JD, et al. Spasticity and functional outcomes post-stroke: An observational study. J Stroke Cerebrovasc Dis. 2016; 25:2121-2127.
15. Winstein CJ, et al. Guidelines for adult stroke rehabilitation and recovery: A guideline from the American Heart Association/American Stroke Association. Stroke. 2016;47: e98-e169.