ORIGINAL RESEARCH   ORİJİNAL ARAŞTIRMA

The Relationship Between the Severity of Post-Stroke Depressive Symptoms and Clinical Findings

İnme Sonrası Depresif Semptom Şiddeti İle Klinik Bulgular Arasında İlişki

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ABSTRACT Objective: To investigate the relationship between the severity of post-stroke depressive symptoms and patients' functional activity level, ambulation status, and clinical characteristics. **Material and Methods:** Ninety-eight stroke patients who were undergoing inpatient rehabilitation at İstanbul Physical Therapy and Rehabilitation Training and Research Hospital were included in this study. The severity of depressive symptoms was assessed using the Hamilton Depression Rating Scale, functional status was assessed using the Barthel Index (BI), and ambulation status was assessed using the Functional Ambulation Classification (FAC). Patients were categorized into 3 groups based on the severity of their depressive symptoms: no depressive symptoms, mild depressive symptoms, and moderate depressive symptoms. levels of functional activity, ambulation status, and clinical characteristics were then compared across these groups. **Results:** The patients had a mean age of 65.4±8.7 years. The mean BI score was significantly higher in the group with no depressive symptoms compared to the group with mild or moderate depressive symptoms (64.5±27.8, 45.0±30.3 and 38.3±29.6 respectively). The median scores for Brunnstrom lower extremity and FAC were significantly higher in the group no depressive symptoms compared to those with moderate depressive symptoms [Brunnstrom lower extremity median (interquartile range) 3.50 (3.00-5.00) vs. 2.50 (2.00-4.00), p=0.007; FAC median (interquartile range) 3.00 (2.00-5.00) vs. 1.00 (0.00-4.00), p=0.004]. **Conclusion:** The severity of post-stroke depressive symptoms may be correlated with patients' functional status and level of ambulation. Therefore, early recognition and effective management of these symptoms could improve patients' long-term prognosis.

Keywords: Stroke; depression; rehabilitation; prognosis

ÖZET Amaç: İnme sonrası depresif semptom şiddeti ile hastaların fonksiyonel aktivite düzeyi, ambulasyon durumu ve klinik özellikleri ile ilişkisini ortaya koymak amaçlanmıştır. **Gereç ve Yöntemler:** Çalışmaya, İstanbul Fizik Tedavi ve Rehabilitasyon Eğitim ve Araştırma Hastanesi'nde yatarak rehabilitasyon gören 98 inme hastası dâhil edildi. Hastaların depresif semptom şiddeti Hamilton Depresyon Değerlendirme Ölçeği ile, fonksiyonel durumu Barthel İndeksi (Bİ) ile, ambulasyon durumu Fonksiyonel Ambulasyon Sınıflaması (FAS) ile değerlendirildi. Depresif semptom şiddetlerine göre hastalar depresyon olmayan, hafif derece depresyon ve orta derecede depresyon olarak 3 gruba ayrıldı. Hastaların fonksiyonel aktivite düzeyi, ambulasyon durumu ve klinik özellikleri bu gruplar arasında karşılaştırıldı. **Bulgular:** Hastaların yaş ortalaması 65,4±8,7 yıl idi. Bİ ortalamasının depresyon olmayan grupta, hafif ve orta derece depresyon olan gruba göre istatistiksel anlamlı olarak daha yüksekti (sırasıyla 64,5±27,8; 45,0±30,3 ve 38,3±29,6). Brunnstrom alt ekstremite ve FAS ortalamaları depresyon olmayan grupta orta derece depresyon olan gruba göre daha yüksekti [sırasıyla Brunnstrom alt ekstremite için medyan (çeyrekler arası aralık) 3,50 (3,00-5,00) ve 2,50 (2,00-4,00), p=0,007; FAS için medyan (çeyrekler arası aralık) 3,00 (2,00-5,00) ve 1,00 (0,00-4,00), p=0,004]. **Sonuç:** İnme sonrası depresif semptom şiddeti, hastaların fonksiyonel durumu ve ambulasyon seviyesi ile ilişkili olabilir. Bu nedenle inme sonrası depressif semptomun erken tanınması ve etkili yönetimi hastaların uzun vadeli prognozunu iyileştirebilir.

Anahtar Kelimeler: İnme; depresyon; rehabilitasyon; prognoz

Stroke is a prevalent and severe disease characterized by high rates of mortality, morbidity, disability, and recurrence.[1] Following a stroke, a significant proportion of patients lose their functional independence and require care.

Post-stroke depression (PSD) occurs at a rate of up to 30%.[2] Due to neurological impairments, the actual prevalence is likely higher as many cases go undiagnosed or unreported.[3] As a common complication of stroke, depressive disorders are as significant as motor and sensory deficits.

PSD can hinder patients' active participation in rehabilitation, making functional recovery more challenging.[4] Additionally, it can lead to cognitive impairment, polypharmacy, fatigue, prolonged hospitalization, social isolation, and suicidal ideation. Therefore, early diagnosis, treatment, and understanding of the associated factors of PSD are of paramount importance.

The aim of this study is to investigate the relationship between the severity of PSD symptoms and patients' functional activity level, ambulation status, and clinical characteristics.

MATERIAL AND METHODS

This study was a cross-sectional observational, descriptive and cross-sectional study. It was conducted between May 01, 2024-May 15, 2024 at İstanbul Physical Therapy and Rehabilitation Training and Research Hospital. A total of 98 patients who developed hemiplegia following a stroke and were undergoing inpatient rehabilitation at İstanbul Physical Therapy and Rehabilitation Training and Research Hospital were included in the study. All volunteers provided written informed consent for this study, which adhered to the principles outlined in the Declaration of Helsinki. The study was approved by the Scientific Research Ethics Committee of İstanbul Physical Therapy and Rehabilitation Training and Research Hospital (no: 2024-21, date: April 30, 2024).

INCLUSION CRITERIA

- Male and female patients aged 18-80 years
- Patients with ischemic or hemorrhagic stroke

- Patients with The Mini Mental State Examination>17

EXCLUSION CRITERIA

- Pre-stroke depression
- Aphasic patients
- Hearing impairment
- Pre-existing psychiatric diagnoses (learning disabilities, mental disorders, autism spectrum disorder)
- Pre-stroke psychiatric medication use

Clinical and demographic data were collected for all patients. The severity of depressive symptoms was assessed using the Hamilton Depression Rating Scale (HDRS), functional status was assessed using the Barthel Index (BI), and ambulation status was assessed using the Functional Ambulation Classification (FAC).

Patients were categorized into three groups based on the severity of their depressive symptoms: no depressive symptoms, mild depressive symptoms, and moderate depressive symptoms. The groups were compared pairwise in terms of clinical characteristics that were statistically significant.

HAMILTON DEPRESSION RATING SCALE

HDRS is a 17-item scale that assesses depressive symptoms over the past week.[5] The total score ranges from 0 to 53, with higher scores indicating more severe depression. Scores of 0-7 indicate no depression, 8-15 indicate mild depression, 16-28 indicate moderate depression, and 29 or higher indicate severe depression.[6] The Turkish validity and reliability study of the HDRS was conducted by Akdemir et al.[7]

BARTHEL INDEX

The Turkish-adapted, validated, and reliable version of the BI was used.[8] The BI consists of 10 main items that assess feeding, transfers from wheelchair to bed and vice versa, personal care, sitting and getting up from the toilet, bathing, walking on a flat surface or using a wheelchair, climbing stairs, dressing and undressing, and bowel and bladder care. The total score ranges from 0 to 100, with 0-20 indicating complete dependence, 21-61 indicating severe dependence, 62-90 indicating

moderate dependence, 91-99 indicating mild dependence, and 100 indicating complete independence.

FUNCTIONAL AMBULATION CLASSIFICATION

The FAC measures the level of support patients need while walking.[9] The scale consists of 6 categories with scores ranging from 0 to 5. In stage 0, patients have non-functional ambulation, while in stage 5, they are able to ambulate independently.[10] The FAC has been shown to be reliable and have good predictive value in hemiparetic patients.[11]

BRUNNSTROM RECOVERY STAGE

According to the Brunnstrom method, motor recovery of the upper extremity, hand, and lower extremity consists of 6 stages.[12]

STATISTICAL ANALYSIS

The normality of the data distribution was assessed using the Lilliefors-corrected Kolmogorov-Smirnov test. Data with a normal distribution were summarized as mean (±standard deviation), while non-normally distributed data were summarized as median (interquartile range). Categorical data were summarized as frequency (percentage). The means of independent groups were compared using the Kruskal-Wallis test. Posthoc pairwise comparisons were made using the Mann-Whitney U test. Bonferroni correction was applied to adjust the p-values for "post hoc" pairwise comparisons. Statistical significance was set at $p < 0.05$. Data management and analysis were performed using PASW Statistics for Windows, Version 18.0 (SPSS Inc., Armonk, NY).

▌ RESULT

The mean age of the patients was 65.4±8.7 years. Patients' socioeconomic and stroke characteristics are summarized in Table 1.

Based on HDRS results, 38.8% of patients showed no depressive symptoms, 30.6% had mild depressive symptoms, and 30.6% had moderate depressive symptoms. According to the BI, 28.6% of patients were fully dependent, while 5.1% were fully independent. According to the FAC, 23.5% of the patients were non-functional, while 21.4% were independent (Table 2).

TABLE 1: Patients' socioeconomic and stroke characteristics.

		n (%)	X̄±SD
Age (years)			65.4±8.7
Height (cm)			164.6±8.7
Weight (kg)			79.0±12.5
Stroke duration (months)			5.5±3.2
Gender	Male	33 (33.7%)	
	Female	65 (66.3%)	
Marital status	Married	77 (78.6%)	
	Single	21 (21.4%)	
Education status	İliterate	26 (26.5%)	
	Primary school	49 (50.0%)	
	Secondary school	8 (8.2%)	
	High school	11 (11.2%)	
	University college	4 (4.1%)	
Employment status	Employed	13 (13.3%)	
	Retired	29 (29.6%)	
	Unemployed	4 (4.1%)	
	Housewife	52 (53.1%)	
Dominant hand	Right	94 (95.9%)	
	Left	4 (4.1%)	
Etiology	İschemic	70 (71.4%)	
	Hemorrhagic	28 (28.6%)	
Plegic side	Right	43 (43.9%)	
	Left	55 (56.1%)	
Lesion location	MCA	63 (63.3%)	
	ACA	14 (14.3%)	
	Posterior Circulation	21 (21.4%)	

SD: Standard deviation

TABLE 2: Clinical characteristics of patients.

		n (%)
Depression severity	No depressive symptoms	38 (38.8%)
	Mild depressive symptoms	30 (30.6%)
	Moderate depressive symptoms	30 (30.6%)
	Severe depressive symptoms	0
Barthel Index	Complete dependence	28 (28.6%)
	Severe dependence	31 (31.6%)
	Moderate dependence	26 (26.5%)
	Mild dependence	8 (8.2%)
	Complete independence	5 (5.1%)
Functional Ambulation Classification	Nonfunctional	23 (23.5%)
	Second level dependent	10 (10.2%)
	First level dependent	16 (16.3%)
	Supervised dependent	15 (15.3%)
	Independent on Flat Ground	13 (13.3%)
	Independent	21 (21.4%)

No statistically significant differences were found in patient age, stroke duration, Brunnstrom

TABLE 3: Comparison of clinical characteristics by the level of depressive symptoms.				
	No depressive symptoms	Mild depressive symptoms	Moderate depressive symptoms	p value
Age (years)	64.4±10.1	65.0±7.8	67.0±7.5	0.608
Stroke duration (months)	5.9±3.3	6.0±3.5	4.4±2.7	0.099
Brunnstrom upper extremity	3.00 (2.00-4.25)	2.00 (1.75-4.00)	2.00 (1.00-4.00)	0.145
Brunnstrom hand	3.00 (1.00-5.00)	2.50 (1.00-5.00)	2.00 (1.00-4.25)	0.306
Brunnstrom lower extremity	3.50 (3.00-5.00)	3.00 (2.00-4.00)	2.50 (2.00-4.00)	**0.008**
Barthel Index	64.5±27.8	45.0±30.3	38.3±29.6	**0.001**
Functional Ambulation Classification	3.00 (2.00-5.00)	2.00 (0.75-4.00)	1.00 (0.00-4.00)	**0.005**

Kruska-Wallis test; The data were presented as mean±standard deviation or median (interquartile range).

upper extremity, or hand scores according to the severity of depressive symptoms as assessed by the HDRS ($p>0.05$) (Table 3). Significant differences were found in BI, FAC, and Brunnstrom lower extremity scores according to the severity of depressive symptoms as assessed by the HDRS ($p<0.05$). ($p<0.05$) (Table 3). The mean BI was significantly higher in the group with no depressive symptoms compared to those with mild or moderate depressive symptoms (64.5±27.8, 45.0±30.3, and 38.3±29.6, respectively) ($p<0.05$) (Table 3 and Table 4).

The median scores for Brunnstrom lower extremity and FAC were significantly higher in the group no depressive symptoms compared to those with moderate depressive symptoms [Brunnstrom lower extremity median (interquartile range) 3.50 (3.00-5.00) vs. 2.50 (2.00-4.00), $p=0.007$; FAC median (interquartile range) 3.00 (2.00-5.00) vs. 1.00 (0.00-4.00), $p=0.004$] (Table 3 and Table 4).

However, no statistically significant differences were found in the mean BI, FAC, and Brunnstrom lower extremity scores between the groups with mild and moderate depressive symptoms ($p>0.05$) (Table 4).

DISCUSSION

Stroke remains a major public health issue, affecting a large portion of society due to its high incidence and mortality rates.[13] The increasing number of stroke survivors will lead to a greater number of patients facing disability.[14] This will create significant challenges in meeting the growing need for rehabilitation and long-term care among patients.[15] To minimize these challenges, rehabilitation plans should be developed with an awareness of the complications that hinder patients' active participation in rehabilitation and prolong hospital stays.

Stroke patients may experience various emotional and behavioral disturbances post-stroke. Major and minor depression are the most common mood disorders among stroke patients. Unmet needs can contribute to the development of depressive symptoms.[16] PSD is a prevalent stroke complication characterized by hopelessness, anxiety, irregular sleep, and diminished emotional responsiveness.[17] The highest risk of developing depression occurs within the first three months post-stroke, with depressive symptoms likely to persist or recur during the following 12 months post-stroke.[16,18]

TABLE 4: Pairwise comparison of groups by the level of depressive symptoms.			
	Brunnstrom lower extremity	Barthel Index	Functional Ambulation Classification
	p value	p value	p value
No depressive symptoms-Mild depressive symptoms	0.197	**0.036***	0.21
Mild depressive symptoms-Moderate depressive symptoms	0.765	1	0.555
No depressive symptoms-Moderate depressive symptoms	**0.007***	**0.001***	**0.004**

Mann-Whitney U test

A review of the literature revealed that the prevalence of PSD was higher in our study compared to other studies.[19,20] In this study, patients were not evaluated for depression using Diagnostic and Statistical Manual of Mental Disorders-5 diagnostic criteria; however, depressive symptoms were identified in 61.2% of the patients. This finding may be explained by the inclusion of patients with more severe clinical deficits, who were hospitalized and underwent rehabilitation. Additionally, the use of the self-reported HDRS to evaluate depressive symptom severity could have influenced the results.

Karaahmet et al. investigated the impact of PSD on functional recovery and the factors that may contribute to PSD. They used the Beck Depression Inventory to assess depression severity and the Functional Independence Measure (FIM) to evaluate functional status. Apart from age and disease duration, factors such as sex, hemiplegic side, stroke severity, stroke etiology, neglect, spasticity, sedentary lifestyle, poststroke immobility, and timing of rehabilitation initiation did not significantly influence the development of depression. A statistically significant difference was found in FIM scores between patients with and without depression, with those without depression demonstrating higher scores.[21]

Gainotti et al. investigated the effects of PSD and its treatment on functional recovery in a study where they used the HDRS to assess depression severity and the BI to assess functional status. They reported that the functional recovery of patients who were depressed but did not receive depression treatment was significantly worse than that of those who were not depressed and those who were depressed and received treatment.[22] We also used the HDRS to measure depression severity and the BI to assess functional status. The No-depression group was found to have significantly higher mean BI scores than both the Mild and Moderate depression groups. Although our study was cross-sectional, limiting causal inferences, the results suggest a potential association between depressive symptoms and patients' current functional status.

Herrmann et al. investigated the association between PSD and functional status. While they found no relationship between depressive symptoms and

factors like age, lesion size, or location, they did identify a significant association between depressive symptoms and functional status. This suggests that PSD may be related to a poorer functional prognosis.[23] We also did not find an association between depressive symptoms and patient age or stroke duration in our study.

Our study found an association between PSD, functional status and ambulation, and determined that as depression severity increased, functional independence and ambulation level decreased.

Raju et al. found that stroke patients with lower functional independence had significantly higher levels of depressive symptoms than those who were more independent.[24] This highlights the importance of the diagnosis and treatment of PSD to help stroke patients achieve the greatest possible functional independence.

We believe that our results are parallel to these findings and that depression and functional recovery may be related.

STUDY LIMITATIONS

Our study had several limitations. First, the cross-sectional design limited the ability to assess changes over time and establish causal relationships between variables. Second, relying solely on self-reported questionnaires to assess depressive symptoms severity may have introduced bias and limited the accuracy of the assessment.

CONCLUSION

This study suggests that the severity of post-stroke depressive symptoms may be correlated with patients' functional status and level of ambulation. Early recognition and effective management of these symptoms can improve patients' long-term prognosis. Therefore, the authors recommend conducting long-term follow-up studies.

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