

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 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. The 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 than in 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 the Brunnstrom lower extremity and FAC were significantly higher in the group with 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 the patients' functional status and level of ambulation. Therefore, early recognition and effective management of these symptoms could improve patients' long-term 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 ekstremitte ve FAS ortalamaları depresyon olmayan grupta orta derece depresyon olan gruba göre daha yüksekti [sırasıyla Brunnstrom alt ekstremitte 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 depresif semptomun erken tanınması ve etkili yönetimi hastaların uzun vadeli prognozunu iyileştirebilir.

Keywords: Stroke; depression; rehabilitation; prognosis

Anahtar Kelimeler: İnme; depresyon; rehabilitasyon; prognoz

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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 was 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 and 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), the functional status was assessed using the Barthel Index (BI), and the 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 ranged 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 ranged from 0 to 100, with 0-20 indicating complete dependence, 21-61 indicating severe dependence, 62-90 in-

dicating 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, whereas in stage 5, they can ambulate independently.¹⁰ The FAC is reliable and to 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 (\pm standard deviation), while non-normally distributed data were summarized as the median (interquartile range). Categorical data are summarized as frequency (percentage). The means of the independent groups were compared using the Kruskal-Wallis test. Post hoc pairwise comparisons were made using the Mann-Whitney U test. The 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. The patients' socioeconomic and stroke characteristics are summarized in [Table 1](#).

Based on the HDRS results, 38.8% of the 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 pa-

TABLE 1: Patients' socioeconomic and stroke characteristics.

		n (%)	$\bar{X} \pm SD$
Age (years)			65.4 \pm 8.7
Height (cm)			164.6 \pm 8.7
Weight (kg)			79.0 \pm 12.5
Stroke duration (months)			5.5 \pm 3.2
Gender	Male	33 (33.7%)	
	Female	65 (66.3%)	
Marital status	Married	77 (78.6%)	
	Single	21 (21.4%)	
Education status	Illiterate	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	Ischemic	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	21 (21.4%)	
	Circulation		

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%)

tients were non-functional, while 21.4% were independent ([Table 2](#)).

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).

No statistically significant differences were found in patient age, stroke duration, Brunnstrom 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 with 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, Table 4).

The median scores for the Brunnstrom lower extremity and FAC were significantly higher in the group with 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, 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 the 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 patients with stroke. 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 3 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 p value	Barthel Index p value	Functional Ambulation Classification 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 than in other studies.^{19,20} In this study, patients were not evaluated for depression using the 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 HDRS to assess depression severity and 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 HDRS to measure depression severity and 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 the 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 the severity of depressive symptoms 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 the 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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Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. However, due to patient confidentiality and ethical considerations, the data are not publicly accessible

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