



Research Article

Section: Psychiatry

Prevalence of Depression in Stroke Survivors and the Relationship between Site of Lesion and Duration of Stroke Onset on Post stroke Depression

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ABSTRACT

Introduction: Poststroke depression (PSD) is a common psychological complication, affecting about one-third of stroke survivors. It can negatively impact rehabilitation efforts, quality of life, and overall recovery outcomes. Factors such as brain lesion location, stroke severity, and time since onset are critical in the development of PSD. Understanding the prevalence and contributing factors of PSD is essential for improving comprehensive care for stroke survivors.

Objective: This study aims to estimate the prevalence of depression in stroke survivors and investigate the relationship between lesion site and duration of stroke onset with PSD.

Methods: A cross-sectional study was conducted with 200 stroke survivors at a neurology outpatient clinic. Depression was assessed using the PHQ-9 scale, with a score of 10 or above indicating significant depression. Brain imaging identified lesion locations, and stroke duration was categorized into specific time groups. Data were analyzed using descriptive statistics, chi-square tests, and logistic regression, with a significance level of $p < 0.05$.

Results: The prevalence of Post-Stroke Depression (PSD) was 31.49%, with the highest occurrence observed in individuals aged 61-70 (41.67%). Males were disproportionately affected, accounting for 69% of cases. A significant association was noted between PSD and left cortical lesions ($p < 0.001$). Furthermore, PSD prevalence increased with stroke duration, reaching its peak between 6 months and 2 years post-stroke ($p < 0.001$).

Conclusion: The study underscores the high prevalence of PSD in stroke survivors, particularly those with left cortical lesions and those 6 months to 2 years post-stroke. Early detection and continuous mental health support are crucial in enhancing recovery and quality of life for stroke survivors.

INTRODUCTION

Poststroke depression (PSD) is a significant psychological complication that affects a large number of stroke survivors. It is estimated that approximately one-third of individuals who experience a stroke will also develop depression at some point in their recovery [1]. The emotional and psychological toll of poststroke depression can be profound, often complicating physical rehabilitation efforts, diminishing quality of life, and negatively influencing long-term recovery outcomes. PSD is influenced by various factors, including the location of the brain lesion, the severity of the stroke, pre-existing mental health conditions, and the length of

time that has passed since the stroke [2]. A deeper understanding of the prevalence of PSD and its contributing factors is critical to ensure that stroke survivors receive comprehensive care that addresses both their physical and mental health needs [3].

The prevalence of PSD varies widely across different studies, with estimates ranging from 20% to 50%. This variation can be attributed to differences in the populations studied, the methodologies used to assess depression, and the clinical criteria employed to diagnose it [4]. The symptoms of PSD often overlap with the physical and cognitive impairments that are common in stroke survivors, making it difficult to distinguish between the effects of the stroke itself and those of depression [5].

For example, fatigue, lack of motivation, cognitive difficulties, and apathy may be indicative of both stroke-related impairments and depressive symptoms, which can complicate diagnosis and treatment. Despite these diagnostic challenges, the high incidence of PSD highlights the importance of addressing mental health as a critical component of stroke recovery [6]. Depression can significantly hinder a patient's willingness to engage in rehabilitation and can slow down the overall recovery process. It has also been linked to poorer cognitive outcomes and higher mortality rates, making early detection and management of PSD crucial [7].

Several biological, psychological, and social factors contribute to the development of PSD. Biologically, the site and extent of the brain damage caused by the stroke play a crucial role. Certain brain regions are more strongly associated with depression following a stroke, particularly areas involved in mood regulation [8]. Lesions in the left hemisphere of the brain, especially in the frontal lobe and basal ganglia, have been linked to a higher risk of developing depression. This association is thought to be due to the disruption of brain networks that control mood and emotional responses [9]. Psychological and social factors also play a significant role. Stroke survivors often experience drastic changes in their lives, such as reduced mobility, loss of independence, and social isolation, all of which can increase the risk of depression [10]. Additionally, individuals with a history of mental health issues, such as depression or anxiety, are more likely to experience PSD. The emotional adjustment required after a stroke, combined with the stress of coping with new limitations, may further heighten the risk of depression [11].

One key area of research in PSD has focused on the relationship between the location of the brain lesion and the likelihood of developing depression. Some studies suggest that lesions in the left hemisphere, particularly those affecting the frontal lobe, are more likely to result in depression. The left anterior region of the brain, in particular, has been implicated due to its role in regulating emotions and executive functions [12].

Damage to this area can impair the brain's ability to control mood, leading to depressive symptoms. While the left hemisphere has been the primary focus of research, there is also evidence that right hemisphere lesions may contribute to PSD, particularly when they involve areas related to emotion perception and social cognition [13]. However, the relationship between lesion location and PSD is complex, and not all studies have found consistent results. While lesion site is undoubtedly an important factor, it interacts with other variables, such as the severity of the stroke and the individual's psychological resilience, to influence the development of PSD [14].

The duration of stroke onset also plays a significant role in the development of PSD. Depression can arise at various points in the recovery process, but some studies suggest that it is most common during the acute phase, typically within the first few months after the stroke [15]. During this time, survivors are often dealing with the immediate physical and emotional impact of the stroke, which can contribute to feelings of helplessness and depression. However, PSD is not limited to the acute phase; it can also develop

later in recovery, sometimes months or even years after the stroke [16]. This late-onset PSD may be related to the long-term challenges of living with the consequences of a stroke, including chronic disability, reduced quality of life, and ongoing social isolation. The brain's ongoing adaptation to the stroke lesion, combined with these social and emotional factors, may trigger or exacerbate depression as time progresses [17].

Poststroke depression is a common and serious complication that affects a substantial proportion of stroke survivors. Understanding the factors that contribute to PSD, such as the site of the brain lesion and the time elapsed since the stroke, is crucial for improving outcomes in stroke rehabilitation [18]. While certain brain regions, such as the left anterior hemisphere, are more strongly associated with PSD, the condition is influenced by a complex interplay of biological, psychological, and social factors. Additionally, the risk of PSD evolves over time, with both early and late phases of stroke recovery presenting different challenges for mental health [19]. A comprehensive approach to stroke care that includes early detection and treatment of depression, along with consideration of lesion location and the duration of stroke onset, is essential for improving the quality of life and recovery outcomes for stroke survivors [20].

The aim of this study is to estimate the prevalence of depression in stroke survivors and examine the relationship between the site of the lesion and the duration of stroke onset in poststroke depression. The specific objectives are to assess the prevalence of depression in stroke survivors, investigate the correlation between the lesion site and poststroke depression, and explore the relationship between the duration of stroke and the occurrence of poststroke depression.

MATERIALS AND METHODS

This cross-sectional study aimed to assess the prevalence of depression in stroke survivors and its relationship with lesion site and stroke duration. Conducted in a neurology outpatient clinic, 200 stroke survivors aged 18 and above were recruited. Depression was assessed using the PHQ-9, with scores of 10+ indicating significant depression. Brain imaging (CT/MRI) identified lesion locations, and stroke duration was categorized into time groups. Data were analyzed using descriptive statistics, chi-square tests, and logistic regression, with a p-value of <0.05 considered significant. Ethical approval was obtained, and participants with depression were referred for further mental health care.

RESULTS

The data shows that depression post-stroke is more prevalent in older individuals, with the highest frequency (41.67%) in the 61-70 age group and a mean age of 62.06 years. Depression is notably less common in younger stroke survivors (<40 years). Regarding gender distribution, 69% of participants are male and 31% are female, indicating a higher prevalence of depression among males in this study. This gender disparity may be influenced by biological, social, or psychological factors contributing to the differences in poststroke depression rates.

Table 1: Distribution of Major Depressive Disorder (MDD) by Lesion Site in Stroke Survivors

Lesion Site	No	Yes
Left Basal Ganglia	4	2
Left Cortex	12	26
Left Mamillary Body	4	0
Left Subthalamus	2	0
Left Thalamus	5	2
Right Basal Ganglia	6	0
Right Cortex	17	2
Right Putamen	4	0
Right Subthalamus	11	0
Right Thalamus	9	2
Total	74	34
Chisquare statistic (χ^2): 41.25		
*p-value: <0.001		
Degrees of Freedom : 9		

The data highlights a significant association between brain lesion sites and Major Depressive Disorder (MDD) in stroke survivors. The Left Cortex shows the highest frequency, with 26 out of 38 individuals having MDD. In contrast, regions like

the Right Subthalamus, Right Basal Ganglia, and Right Putamen have no MDD cases. A Chi-square statistic of 41.25 ($p < 0.001$) confirms this strong relationship.

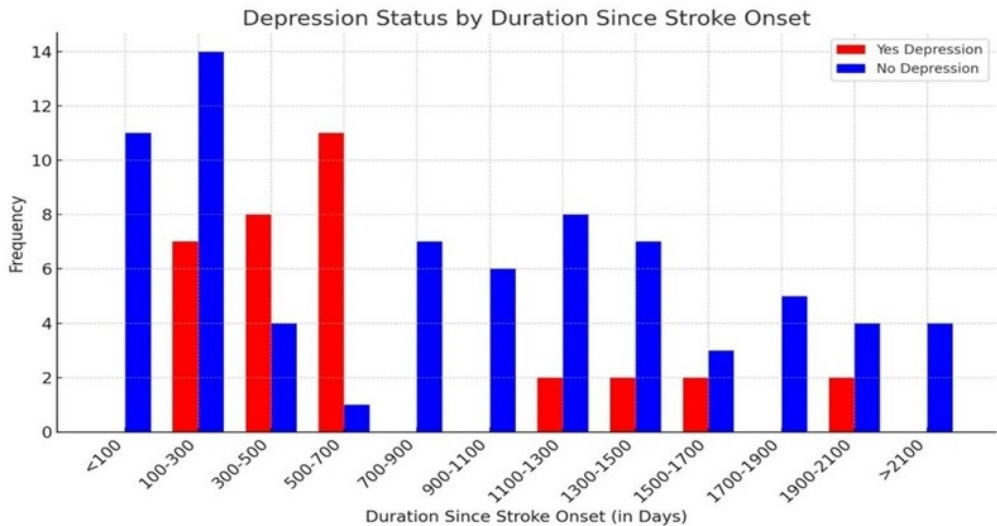


Figure 1: Depression Status by Duration Since Stroke Onset Among Stroke Survivors

The data shows a significant increase in Major Depressive Disorder (MDD) prevalence as the duration since stroke onset increases, with the highest depression rate in individuals 500-700 days post-stroke (11 out of 12 affected).

No cases are observed within 100 days of stroke onset. A Chi-square statistic of 43.38 ($p < 0.001$) confirms a strong association between stroke duration and depression risk.

Table 2: Prevalence of Major Depressive Disorder (MDD) by Duration Since Stroke Onset

Duration Since Stroke Onset	MDD	
	No	Yes
6 Months to 2 years	5	21
< 6 Months	25	5
>2 years	44	8
Total	74	34
Chisquare statistic (χ^2): 38.58		
*p-value: <0.001		
Degrees of Freedom: 2		

The prevalence of Major Depressive Disorder (MDD) is highest in stroke survivors 6 months to 2 years post-stroke (21 cases), compared to fewer cases in those less than 6 months (5 cases) or more than 2 years post-stroke (8 cases). A significant association ($\chi^2 = 38.58, p < 0.001$) underscores this intermediate period as critical for MDD onset, emphasizing the need for targeted interventions.

Table 3: Prevalence of Major Depressive Disorder (MDD) by Gender

Gender	MDD	
	No	Yes
Female	21	13
Male	53	21
Total	74	34
Chisquare statistic (χ^2): 0.642		
p-value: 0.423		
Degrees of Freedom: 1		

Among 108 stroke survivors, 31.49% have Major Depressive Disorder (MDD), with more males (21 of 74) affected than females (13 of 34). However, the Chi-square test ($\chi^2 = 0.642, p = 0.423$) shows no statistically significant association between gender and MDD prevalence. This suggests that the likelihood of experiencing MDD post-stroke is similar between males and females.

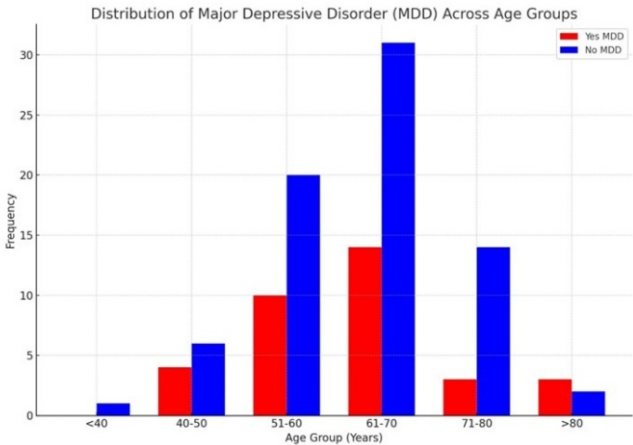


Figure 2: Distribution of Major Depressive Disorder (MDD) Across Age Groups Among Stroke Survivors

The prevalence of Major Depressive Disorder (MDD) is highest among stroke survivors aged 61-70 (14 cases) and 51-60 (10 cases), while younger (<40) and older (>80) age groups have fewer cases. However, the Chi-square test ($\chi^2 = 4.24$, $p = 0.515$) indicates no statistically significant association between age group and MDD prevalence, suggesting similar risk across age ranges.

Table 4: Depression Status by Gender and Duration Since Stroke Onset Among Stroke Survivors

Gender	Duration Since Stroke Onset	No Depression	Yes, Depression	Chi-square statistics
Female	6 Months to 2 years	2	8	Chi-square statistic (χ^2): 12.28; p-value: 0.0022
	< 6 Months	7	0	
	>2 years	12	5	
Male	6 Months to 2 years	3	13	Chi-square statistic (χ^2): 29.26; *p-value: <0.001
	< 6 Months	18	5	
	>2 years	32	3	
Total		74	34	

The analysis shows a significant association between stroke duration and Major Depressive Disorder (MDD) for both genders, particularly between 6 months and 2 years post-stroke. Females in this duration range have the highest MDD cases (8), while males have 13. Chi-square tests confirm strong associations ($p < 0.001$ for males, $p = 0.0022$ for females). MDD prevalence is lower for strokes less than 6 months or beyond 2 years.

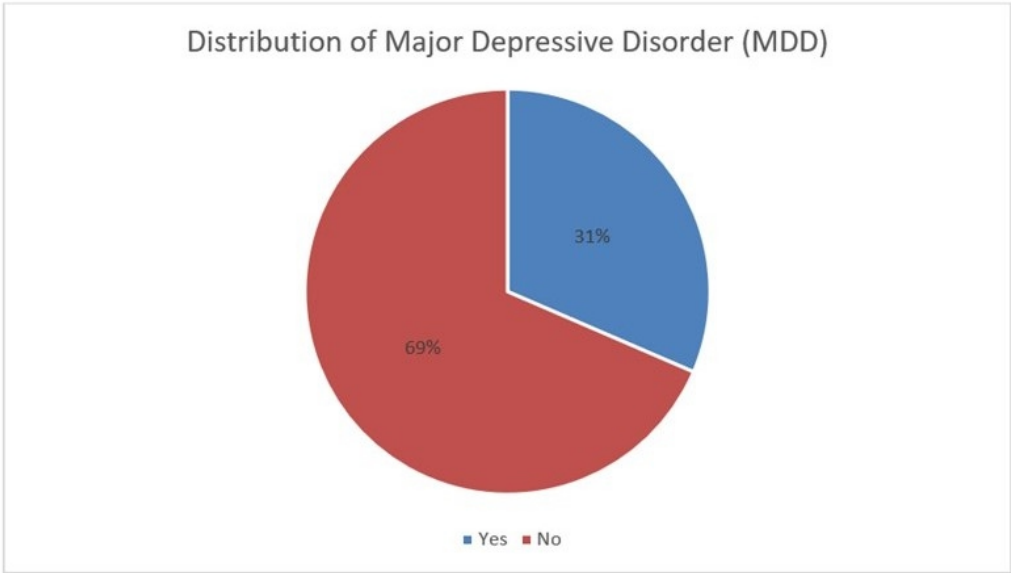


Figure 3: Prevalence of Major Depressive Disorder (MDD) Among Stroke Survivors

Among 108 stroke survivors, 31.49% are diagnosed with Major Depressive Disorder (MDD), while 68.51% are not affected. This highlights that nearly one-third of stroke survivors experience significant depression, emphasizing the psychological impact of stroke. The prevalence of MDD in this population underscores the importance of incorporating mental health evaluation and intervention into stroke rehabilitation and recovery processes.

Table 5: Distribution of Duration since Stroke Onset among Stroke Survivors with Depression

Duration Since Stroke Onset	Frequency	Percentage
< 6 Months	30	27.78
6 Months to 2 years	26	24.07
>2 years	52	48.15
Total	108	100

The distribution of stroke duration among survivors shows that 48.15% had strokes over two years ago, 27.78% within the last six months, and 24.07% between six months and two years. This indicates a significant portion of survivors are in the long-term post-stroke phase, which correlates with a higher prevalence of depression, emphasizing the need for ongoing mental health support.

DISCUSSION

This study aims to estimate the prevalence of depression in stroke survivors and examine its relationship with lesion site and stroke duration. The objectives are to assess depression prevalence, investigate the correlation between lesion location and poststroke depression, and explore how the duration since stroke onset impacts the likelihood of depression. This understanding can guide improved stroke recovery and mental health interventions [21].

Our study aligns with Wongwandee et al. (2012) and Rajashekaran et al. (2013) in highlighting age and gender disparities in post-stroke depression (PSD). Like Wongwandee, we found higher depression rates in individuals under 60, while Rajashekaran observed more cases in the 61-70 group. Gender-wise, our study aligns with Rajashekaran's finding of higher depression prevalence in males, contrasting with Wongwandee's finding of higher rates in females. Both studies also reinforce the link between left-sided brain lesions and Major Depressive Disorder (MDD) in stroke survivors, with our study reporting 67.9% of PSD cases having left-sided lesions [22, 23].

Our study shows a significant increase in Major Depressive Disorder (MDD) prevalence as stroke duration increases, with the highest rate 500-700 days post-stroke, aligning with Rajashekaran et al. (2013) and Zhang et al. (2017). Rajashekaran's findings indicate that depression risk is highest in the initial months post-stroke, while social and disability-related factors contribute more after six months. Zhang et al. observed that post-stroke depression is more common in the subacute phase (1-6 months) with left-hemisphere lesions, but chronic depression (after six months) remains influenced by lesion location, particularly in the right hemisphere [23, 24].

Our study shows that Major Depressive Disorder (MDD) prevalence peaks between 6 months to 2 years post-stroke, aligning with findings by Rajashekaran et al. (2013) and Zhang et al. (2017). Rajashekaran reported that 45.16% of MDD cases occur within the first 6 months post-stroke, with over 50% developing depressive reactions within 2 months. Zhang's

research highlights high MDD prevalence in the acute (≤ 1 month) and subacute (1-6 months) phases, particularly in patients with left hemisphere lesions. In the chronic phase (>6 months), MDD persists, though prevalence diminishes over time, with both hemispheres showing involvement [23,24].

Our study shows that 31.49% of stroke survivors have Major Depressive Disorder (MDD), with no significant gender association ($\chi^2 = 0.642$, $p = 0.423$), aligning with Rajashekaran et al. (2013), where 75% of MDD cases were male. Zhang et al. (2017) presented a contrasting view, with women being more susceptible to post-stroke depression (PSD) during the acute and subacute phases. Their meta-analysis revealed that females had a higher risk of PSD, with an odds ratio of 0.73 in the acute phase and 0.69 in the subacute phase. This suggests mixed findings on gender influence in MDD prevalence post-stroke [23, 24].

Our study found that Major Depressive Disorder (MDD) was most prevalent in stroke survivors aged 61-70 (14 cases) and 51-60 (10 cases), with fewer cases in younger and older groups. This aligns with Rajashekaran et al. (2013), where 50% of MDD cases were in the 51-60 age group and 42.9% in the 61-70 group. However, Wongwandee et al. (2012) reported a higher prevalence of MDD in younger survivors, with 63.6% of cases occurring in those under 60. Despite these variations, no significant age association was found in our study ($\chi^2 = 4.24$, $p = 0.515$) [22, 23].

Our study reveals a significant association between stroke duration and Major Depressive Disorder (MDD), particularly between 6 months to 2 years post-stroke, aligning with findings from Rajashekaran et al. (2013) and Wongwandee et al. (2012). Rajashekaran reported that PSD cases were predominantly male (75%) and prevalent within the first 6 months (45.16%), while Wongwandee found early-onset depression more common in females (54.5%) within the first two weeks. Both studies highlight gender differences in depression timing, with males more affected long-term and females experiencing earlier onset of post-stroke depression [22, 23].

Our study shows that 31.49% of stroke survivors are diagnosed with Major Depressive Disorder (MDD), aligning with Rajashekaran et al. (2013), who reported 45.16% post-stroke depression (PSD) prevalence, including major and minor depression (18 and 10 cases, respectively). Wongwandee et al. (2012) found a slightly lower MDD prevalence (28.2%), with depression severity further categorized: 12.8% mild, 12.8% less than major, and 2.6% major depression. These findings emphasize the substantial psychological impact of stroke across

studies, highlighting the need for integrating mental health care into stroke rehabilitation programs [22, 23].

Our study shows that 48.15% of stroke survivors are over two years post-stroke, correlating with a higher depression prevalence in the long-term phase. Rajashekaran et al. (2013) found over 50% of post-stroke depression (PSD) cases occurred within two months, with the highest prevalence within the first six months. Wongwandee et al. (2012) reported early onset post-stroke depression (28.2%) occurring within two weeks, linked to left-sided lesions, female gender, and lack of hypertension. These findings underscore the need for early and continuous monitoring of depression in both short-term and long-term post-stroke survivors [22, 23].

CONCLUSION

This study emphasizes the significant prevalence of poststroke depression (PSD), affecting 31.49% of stroke survivors. Depression risk is strongly linked to left-hemisphere lesions, particularly the left cortex, and is most prevalent 6 months to 2 years post-stroke. While gender and age did not show a statistically significant effect, the findings highlight the importance of addressing mental health in stroke recovery. Targeted interventions during the critical period following stroke, along with early detection and management of depression, are essential for improving recovery outcomes and enhancing the quality of life for stroke survivors. Continuous monitoring is crucial for long-term care.

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