ORIGINAL ARTICLE

doi: 10.5455/medarh.2014.68.47-50

Published online: 20/02/2014
Published print: 02/2014

Med Arh. 2014 Feb; 68(1): 47-50
Received: November 08th 2013 | Accepted: February 11th 2014


# Post Stroke Depression

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## ABSTRACT

**Introduction:** Comorbidity of depression and stroke significantly reduces the quality of life of patients after the stroke. Squeal after stroke also determines the quality of life and have impact on the occurrence of depression after the stroke. In our study we investigated the occurrence of depression in patients after different types and subtypes of stroke measured by the Hamilton scale compared to the level of disability measured by NIHSS scale. **Goal:** The goal was to make a comparative analysis of depression after stroke, according to gender and age, side of the lesion and the severity of neurological deficit. **Material and Methods:** Material for our work are 210 patients with stroke treated at the Neurology Clinic, Clinical Center of Sarajevo University in 2012, 105 male and 105 female. The mean age of the patients was 67.12±9.5 years. Ischemic stroke was present in 65% cases. There was no statistically significant difference between ischemic and hemorrhagic stroke among genders. In case of hemorrhagic M-56.7%, F-43.3%; ischemic M-48.3%, F-51.7% (chi-square=6.563, p=0.082). Depression was more prevalent among younger patients (52-60 years) with 39.2% then in the group of older patients (61-70 years) with 32% of depressed. In relation to gender there was significantly more patients with depression among women compared to men (63.8:27.2%, chi-square=14.38, p=0.00019). Depression was more frequent in patients with stroke in the left hemisphere medial localization (63%). NIHSS scale average was 16.07 with the minimum of 11 and maximum of 22, F=52.56, p=0.001. **Conclusions:** We can conclude that depression after stroke is more frequent in younger patients, female patients, patients with localized stroke in the medial left hemisphere and with higher disability score.

**Key words: stroke, depression, disability score.**

## 1. INTRODUCTION

According to National Stroke Association the prevalence is 700, 000 annually (500, 000 people with first stroke, and 200, 000 with recurrent stroke) (1, 2).

Data from the literature show that 10% of stroke patients fully recover, 25% of stroke patients recover with minimal consequences, 40% of stroke patients experience severe and serious consequences for which special care is necessary, 10% of stroke patients require constant care in specialized institutions (lifetime) and 15% die shortly after the stroke (3, 4). In the first 30 days die 7.6% of patients with ischemic stroke and 37.5% of patients with hemorrhagic type. Twenty two percent of men and 25% of women die during the first year after stroke, 14% of persons who had a stroke or TIA have a relapse during the first year, 25% of stroke patients experience the second stroke during the next five years with lethal outcome (5, 6).

Post-stroke depression (PSD) is considered the most frequent and important neuropsychiatric consequence of stroke. Approximately one-third of stroke survivors experience major depression. Moreover this condition can have an adverse effect on cognitive function, functional recovery and survival.

The Diagnostic and Statistical Manual (DSM) IV categorizes post-stroke depression as "Mood disorder due to a general medical condition (i.e. stroke)" with the specifiers of depressive features, major depressive-like episodes, manic features, or mixed features (7).

Utilizing patient data from acute hospital admission, community surveys, or outpatient clinics previous studies have identified two types of depressive disorders associated with cerebral ischemia: major depression, which occurs in up to 25% of patients; and minor depression, which has been defined for research purposes by DSM-IV criteria as a depressed mood or loss of interest and at least two but fewer than four symptoms of major depression (7).

Minor depression occurs in up to 30% of patients following stroke. Prevalence clearly varies over time with an apparent peak 3–6 months after stroke and subsequent decline in prevalence at one-year reaches about to 50% of initial rates.

The scientific community is divided into two "groups" supporting opposing views: some propose a primary biological mechanism with stroke affecting neural circuits involved in mood regulation which in turn causes post-stroke depression, while other researchers claim that post stroke depression is caused by social and psychological stressors that emerge as a result of stroke (8).

Despite this evidence, the association of post-stroke de-

pression to specific brain lesions is still vague and needs replication from various independent groups. Furthermore the cause of post stroke depression at a functional level is not clear.

The only biological model was proposed by Robinson and co-workers: They hypothesized that the depletion of monoaminergic amines occurring after stroke plays a role in post stroke-depression (9).

They point out that norepinephrinergic and serotonergic nuclei send projections to the frontal cortex and arc posteriorly, running through the deep layers of the cortex, where they arborize and send terminal projections into the superficial cortical layers. These norepinephrinergic and serotoninergic pathways are disrupted in basal ganglia and frontal lobe lesions – sites that are shown to be associated with post stroke depression.

This model is far from being universally accepted and there are serious objections both to their model and findings showing the association between post-stroke depression and lesion sites.

Several studies show that depression can have behavioral and direct pathophysiological effects on CVD (10).

Depression is associated with inappropriate modification of risk factors such as smoking cessation, poor flexibility, glycaemic control in diabetic patients and poor adherence to taking prescribed medication. As a result, are set direct pathophysiological effects which are linking depression with CVD.

Abnormal platelet function, including increased platelet reactivity, increased levels of platelet factor 4 and B thromboglobulin, increased platelet reactivity to serotonin and reduced platelet reactivity to ADP are considered in this context.

It is also assumed that hypercortisolism and elevated CRF levels may be relevant as additional pathophysiological mechanisms of depression associated with CVD as well as the lack of omega 3 fatty acids and elevated homocysteine levels (12).

Moreover, endothelial dysfunction is observed in depressed patients.

## 2. GOAL

The goal was to make a comparative analysis of depression after stroke, according to gender and age, side of the lesion and the severity of neurological deficit.

## 3. MATERIAL AND METHODOLOGY

Material for our work are 210 patients with stroke treated at the Neurology Clinic, Clinical Center of Sarajevo University in 2012, 105 male and 105 female.

The patients were followed through the acute phase of stroke at the departments of Neurology Clinic, Clinical Center of Sarajevo University, Bosnia and Herzegovina.

Inclusion criteria: Acute phase of stroke (first 14 days), Brain CT, Ability to answer the Beck Depression Inventory.

Exclusion criteria: History of depression, Inability to communicate, Drug addiction, The use of antidepressants before the study, Sensory aphasia.

We used the Beck Depression Inventory as one of the most popular instruments for measuring the intensity of the depression symptoms in clinical and general population. It contains 21 items that are evaluated on a four point scale (0-3), so that higher values indicate greater intensity of the symptoms. The assessment is carried out in relation to the last two weeks according to the manual for the BDI-II scores:

- 0-13 minimal depression;
- 14-19 mild;
- 20 to 28 moderate;
- 29 or more indicate severe depression.

For the assessment of neurological deficit, we used NIHSS scale.

## 4. RESULTS

Results are shown on figure 1 and tables 1,2,3,4,56.

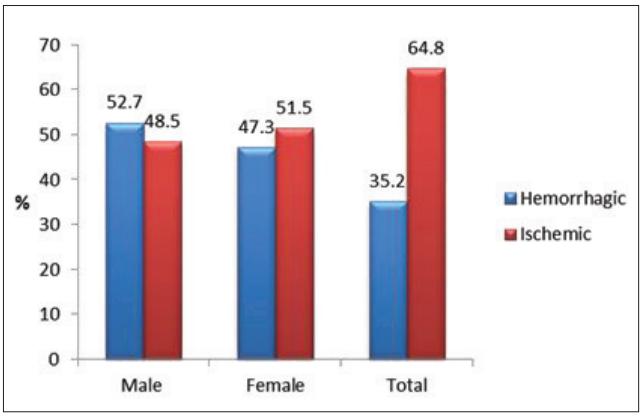


**Figure 1.** Type of stroke according to gender

There was no statistically significant difference between ischemic and hemorrhagic stroke among genders.

In case of hemorrhagic M-52.7%, F-47.3%; ischemic M-47.3%, F-51.5% (Chi-square=6.563, p=0.082

In relation to gender there was significantly more patients with depression among women compared to men (63.8:27.2%), Chi-square=14.38, p=0.00019)

The mean age of the patients was 67.12 with SD 9.5

Depression according to gender

| | | | Depression | | Total |
|---|---|---|---|---|---|
| | | | NO (<13) | YES (>13) | |
| Gender | Male | N | 76 | 29 | 105 |
| | | % | 72.8 | 27.2 | 50.0 |
| | Female | N | 38 | 67 | 105 |
| | | % | 36.2 | 63.8 | 50.0 |
| Total | | N | 70 | 140 | 210 |
| | | % | 33,3 | 66.7 | 100.0 |

**Table 1.** Depression according to gender

Age according to Beck depression score

| Beck depression score | N | Mean | Std. deviation | Std. error | Minimum | **Maximum** |
|---|---|---|---|---|---|---|
| 0 - 13 minimal | 70 | 64.73 | 11.067 | 1.429 | 43 | 83 |
| 14-19 mild | 66 | 65.58 | 9.590 | 1.238 | 44 | 81 |
| 20-28 moderate | 39 | 63.33 | 11.458 | 1.479 | 39 | 86 |
| Above 28 severe | 35 | 60.83 | 8.135 | 1.050 | 33 | 84 |
| Total | 210 | 67.12 | 9.5 | .661 | 33 | 86 |

**Table 2.** Age according to Beck depression score

| Depression according to lesion localization | | | | | |
|---|---|---|---|---|---|
| | | | Depression | | Total |
| | | | NO (<13) | YES (>13) | |
| Lesion localization | Left hemisphere | N | 38 | 76 | 114 |
| | | % | 33.3 | 66.7 | 54.3 |
| | Right hemisphere | N | 62 | 35 | 96 |
| | | % | 64.6 | 35.4 | 45.7 |
| Total | | N | 70 | 140 | 210 |
| | | % | 33.3 | 66.7 | 100.0 |

**Table 3.** Depression according to lesion localization

years. Younger patients had higher depression scores compared to the older population. Depression was more prevalent among younger patients (51-60 yrs.) with 39.2% then in the group of older patients (61-70 yrs.) with 32% of depressed which is statistically significant (p<0, 05).

Depression is statistically significantly higher present in patients with lesions in the left hemisphere: 67%. Patients with lesion in the left hemisphere had depression compared to 35% of patients with lesions in the right hemisphere (p<0.05).

Depression was more frequent in patients with stroke in the left hemisphere medial localization (63%).

Analysis of the frequency of neurologic deficit shows almost linear correlation with the degree of depression, with the exception of quadriparesis which was most pronounced in patients with moderate depression (66.7%).

NIHSS scale average in a baseline sample was 16.07 with the minimum of 11 and maximum of 22, F=52.56, p=0.001. With lowest values in patients with minimal depression (14.2±2.5) and the highest NIHSS score in patients with severe depression (19.15±1.8)

Statistical analysis shows that there are statistically significant differences between the observed groups in relation to the NIHSS score on admission (p<0.01). Higher NIHSS score was positively correlated with depression.

Hospitalization duration shows a linear correlation with the expression of depression, so the patients with lower scores on the Beck depression scale had a shorter hospital stay (days) compared to those with more prominent depression with a statistically significant difference (F=33.653, p=0.0001).

## 5. DISCUSSION

Robinson and colleagues characterized the natural course of major depression after stroke with spontaneous remission typically 1 to 2 years after stroke. However, it was also noted that in few cases depression becomes chronic and may persist for more than 3 years following stroke. On the other hand, minor depression appeared to be more variable, with both short term and long term depression occurring in these patients. Post-stroke depression is highly prevalent among both men and women post-stroke, however, it appears that post-stoke depression is more common in women when prevalence is compared between the sexes (8).

Women were twice more likely to experience post-stroke depression than men. It is hypothesized, based on CT scanning, that of the two sexes experiencing post-stroke depression, women who had post-stroke depression had a higher rate of left hemisphere lesions than men (13, 14).

However, risk of post-stroke depression cannot be determined effectively based on the location of the lesion in the brain and more research in this area is needed (15).

It has also been postulated that the risk of developing post-stroke depression in male patients is partly linked to having a high level of limitations and disability in functioning, especially in performing activities of daily living (ADL's), as a result of their stroke; the greater the limitation, the greater the severity (16).

Risk of developing post-stroke depression in women is partly linked to a past history of psychological disorders, as well as, limitations involving cognition, as a result of their stroke (13, 14).

Post-stroke depression is associated with increased disability, poorer functional and cognitive outcome, has a negative impact on the rehabilitation process, and can

| Depression by neurologic deficit on admission | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | BECK depression score | | | | Total |
| | | | 0 - 13 minimal | 14-19 mild | 20-28 moderate | **Above 28 severe** | |
| Neurologic deficit | Hemiparesis | **N** | 0 | 15 | 14 | 23 | 52 |
| | | % | .0 | 28.8 | 26.9 | 44.2 | 24.8 |
| | Hemiplegia | **N** | 31 | 34 | 31 | 44 | 140 |
| | | % | 22.1 | 24.3 | 22.1 | 31.4 | 66.7 |
| | Quadriparesis | **N** | 0 | 2 | 6 | 22 | 30 |
| | | % | .0 | 6.7 | 20.0 | 73.3 | 14.3 |
| | Quadriplegia | **N** | 2 | 0 | 12 | 4 | 18 |
| | | % | 11.1 | .0 | 66.7 | 22.2 | 8.6 |
| Total | | N | 70 | 66 | 39 | 35 | 210 |
| | | % | 33.3 | 31.4 | 18.5 | 16.7 | 100.0 |

**Table 4.** Depression by neurologic deficit on admission

| NIHSS on admission | | | | | | |
|---|---|---|---|---|---|---|
| Beck depression score | N | Mean | Std. deviation | Std. error | Minimum | **Maximum** |
| 0 - 13 minimal | 70 | 14.18 | 2.528 | .326 | 11 | 22 |
| 14-19 mild | 66 | 14.48 | 2.920 | .377 | 11 | 20 |
| 20-28 moderate | 39 | 16.45 | 2.368 | .306 | 11 | 21 |
| Above 28 severe | 35 | 19.15 | 1.840 | .237 | 14 | 22 |
| Total | 210 | 16.07 | 3.138 | .203 | 11 | 22 |

**Table 5.** NIHSS on admission

| Lenght of hospitalization - days | | | | | | |
|---|---|---|---|---|---|---|
| Beck depression score | N | Mean | Std. deviation | Std. error | Minimum | Maximum |
| 0 - 13 minimal | 70 | 5.83 | 5.450 | .704 | 1 | 21 |
| 14-19 mild | 66 | 11.42 | 7.827 | 1.010 | 4 | 28 |
| 20-28 moderate | 39 | 15.43 | 6.632 | .856 | 3 | 21 |
| Above 28 severe | 35 | 16.18 | 5.044 | .651 | 6 | 24 |
| Total | 210 | 12.22 | 7.519 | .485 | 1 | 28 |

**Table 6.** Length of hospitalization

significantly affect the recovery of function and cognitive function (16).

Incidence of fatigue after stroke ranges from 16% to 70%. Fatigue is one of the most unpleasant symptoms of stroke survivors, and can last for many months and years after a stroke. It can occur as an isolated symptom, but can also be a symptom of depression post stroke and sometimes it is difficult to differentiate (17). In our work, we have given emphasis on fatigue as a specific symptom. We used Beck depression scale including self-assessment of the factors that were interpreted as affective, motivational and cognitive aspects of hopelessness.

NIHSS is a reliable and valid test and can be a predictor of long-term outcome after stroke. In our material it shows as an important parameter in post-stroke depression as comparative results from the literature (18). Values of NIHSS score, presence of depression is an important parameter of quality of life after stroke. Improvement of functional recovery expressed by NIHSS score significantly affect the parameters of the depression in patients after stroke (18).

While an integrated bio-psycho-social model including both biological and psychosocial aspects of post stroke depression seems warranted, a number of studies clearly suggest that biological mechanisms play a major role in the development of post stroke depression (19, 20).

## 6. CONCLUSION

In the baseline sample we had significantly more ischemic stroke compared to hemorrhagic one.

Statistical analysis using Chi-square test showed statistically significant differences in the presence of depression in relation to gender, which was more common in women.

The mean age of the patients was 67.12±9.5 years. Younger patients had higher Beck depression score compared to the older population.

Statistical analysis shows that there are statistically significant differences between the observed groups in relation to the NIHSS score on admission ($p<0.01$). Higher NIHSS score was correlated with depression.

Depression was more frequent in patients with stroke in the left hemisphere (63%).

We can conclude that depression after stroke is more frequent in younger patients, female patients, patients with localized stroke in the left hemisphere and with higher NIHSS disability score.

**CONFLICT OF INTEREST: NONE DECLARED**

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