Frequency and Clinical Determinants of Poststroke Depression

Tarja Pohjasvaara, MD; Antero Leppävuori, MD, PhD; Irina Siira, MD; Risto Vataja, MD; Markku Kaste, MD, PhD; Timo Erkinjuntti, MD, PhD

Background and Purpose—Previous studies have shown a large variation concerning the frequency of poststroke depression. This variation is caused by differences in patient populations, psychiatric assessment methods, and diagnostic criteria. In this study, we evaluated the frequency and clinical correlates of poststroke depression in a large well-defined stroke cohort.

Methods—We studied a consecutive series of 486 patients with ischemic stroke aged from 55 to 85 years. Of these, 277 patients underwent a comprehensive psychiatric evaluation, including the Present State Examination, from 3 to 4 months after ischemic stroke. The criteria of the Diagnostic and Statistical Manual of Mental Disorders, edition 3, revised (DSM-III-R), were used for the diagnosis of depressive disorders.

Results—The frequency of any depressive disorder was 40.1% (n = 111). Major depression was diagnosed in 26.0% (n = 72) and minor depression in 14.1% (n = 39). Major depression with no other explanatory factor besides stroke was diagnosed in 18.0% (n = 49) of the patients. Comparing depressed and nondepressed patients, we found no statistically significant difference in sex, age, education, stroke type, stroke localization, stroke syndrome, history of previous cerebrovascular disease, or frequency of DSM-III-R dementia. According to the multiple logistic regression model, dependency in daily life correlated with the diagnosis of depression (odds ratio [OR], 1.8; 95% confidence interval [CI], 1.1 to 3.1) and with the diagnosis of major depression (OR, 2.9; 95% CI, 1.6 to 5.5). A history of previous depressive episodes also correlated with the diagnosis of depression (OR, 2.3; 95% CI, 1.3 to 4.4) and with the diagnosis of major depression (OR, 2.9; 95% CI, 1.6 to 5.5), whereas solely stroke-related major depression correlated only weakly with stroke severity as measured on the Scandinavian Stroke Scale (OR, 1.1; 95% CI, 1.0 to 1.1).

Conclusions—Clinically significant depression is frequent after ischemic stroke. We emphasize the importance of the psychiatric examination of poststroke patients, especially those with a significant disability and with a history of prior depressive episodes. (Stroke. 1998;29:2311-2317.)

Key Words: cerebral ischemia • depression • diagnosis • Finland

The reported frequency of poststroke depression (PSD) in previous studies ranges from 20% to 65%.1 This wide variation in results is due to different criteria for patient selection; earlier studies are concerned with depression after ischemic stroke only or both ischemic and hemorrhagic stroke.2-3 The results also depend on the time elapsed after stroke,4-7 and difficulties in estimating depression in stroke patients with a cognitive or physical handicap also cause inaccuracies.1

PSD is commonly unrecognized and untreated in clinical practice.1,5 According to Schubert et al.,6 nonpsychiatric physicians fail to diagnose 50% to 80% of the actually existing depression. PSD has been related to physical handicap and the limitations in activities of daily living (ADL).8-13 However, PSD is most likely not solely a psychological reflection of a physical disability. Folstein et al14 demonstrated that stroke patients were significantly more commonly depressed than orthopedic patients with equal levels of functional disability. It has been claimed that PSD is related to specific locations of ischemic brain lesions,14,5,9 although this has also been denied.15

The aim of the present study was to evaluate the frequency and clinical correlates of PSD in a large well-defined stroke cohort from 3 to 4 months after ischemic stroke. The investigation makes use of a more versatile methodology than most of the previous studies. We used the Schedules for Clinical Assessment in Neuropsychiatry (SCAN)16 system to assess psychopathological symptoms. The criteria of the Diagnostic and Statistical Manual of Mental Disorders, edition 3, revised (DSM-III-R)17 and International Classifi-
cification of Diseases, 10th Revision (ICD-10)\textsuperscript{18} were used in diagnosing depressive disorders.

Subjects and Methods

The details of procedures in the Helsinki Stroke Aging Memory (SAM) Study have been reported.\textsuperscript{16,18-20} A group of 486 consecutive patients aged from 55 to 85 years were evaluated 3 months after ischemic stroke. The evaluation of each patient was based on (1) their structured medical and neurological history based on a review of all available hospital charts, (2) an interview with the subject and a knowledgeable informant, (3) a structured clinical and neurological examination, and (4) a clinical mental status examination conducted by a board-certified neurologist (T.P.).\textsuperscript{19,20} The cases were also reviewed by a senior neurologist (T.E.). The neurological examination emphasizes the factors and features that are related to dementia and stroke. The procedure is similar to the method of the Memory Research Unit, Department of Neurology, University of Helsinki,\textsuperscript{21} and the National Stroke Data Bank (United States).\textsuperscript{22}

The clinical neurological examination included the Mini-Mental State Examination (MMSE),\textsuperscript{23} the Beck Depression Scale,\textsuperscript{24} and the Barthel Index.\textsuperscript{25} The presence of aphasia was assessed clinically and by using the Acute Aphasia Screening Protocol (AASP).\textsuperscript{26}

The history of main vascular risk factors was collected and for each patient.\textsuperscript{19,20} Types of ischemic stroke were classified according to the TOAST criteria into the following categories: large-artery arteriosclerosis, cardioembolism, small-vessel occlusion (lacunar), and stroke of undetermined etiology.\textsuperscript{27} The localization of the stroke was divided into right hemisphere, left hemisphere, and bilateral, as well as into anterior (carotid), posterior (vertebrobasilar), and anterior-posterior circulation.\textsuperscript{28-34} The stroke syndromes assessed included major and nondominant hemisphere, minor dominant and nondominant hemisphere, deep lacunar, brain stem and cerebellar, and unknown.\textsuperscript{27} Stroke severity was assessed using the Scandinavian Stroke Scale (SSS).\textsuperscript{35}

We applied the clinical criteria for dementia as presented by the DSM-III-R.\textsuperscript{17} Education level of the patients was divided into 2 categories of low and high education corresponding to periods of 0 to 6 years and of &gt;6 years of formal education, respectively.

Dependence was defined on the basis of available history from the patient and a knowledgeable informant and the stroke, handicap, and ADL scales used. Patients who required daily assistance, home attendant help, or admission to a nursing home were judged to be dependent. Our definition is in accordance with the study by Tatemichi et al.\textsuperscript{36}

Clinical neurological and mental status examinations were conducted for 451 patients.\textsuperscript{19} The excluded patients comprised 32 with severe aphasia, 1 with a reduced level of consciousness, 1 with severe hearing impairment, and 1 who refused participation. This group (n = 35) showed a higher ratio of stroke located in the left hemisphere (33 versus 2, P &lt; 0.001) and of more severe stroke as measured on the SSS\textsuperscript{19} (31.3 versus 54.0, P &lt; 0.001), but this group did not differ from the others in terms of main demographic and clinical features including age, sex, educational level, and living condition (alone or with someone else).

Both MRI\textsuperscript{17} of the head and a comprehensive psychiatric examination were conducted for 277 (61.4%) of the 451 patients. The excluded patients (n = 174) comprised 59 patients for whom MRI was not performed (contraindication in 27, refusal in 18, claustrophobia in 2, severe illness in 11, obesity in 1), 85 patients for whom the possibility of psychiatric examination could not be offered during the first 3 months of the study, and 30 who refused examination. The 174 patients who did not undergo psychiatric examination were compared with the 277 who did. No substantial differences were found in the following demographic or clinical factors: age, sex, education, living condition (alone or with someone else), first versus later stroke, side and site of stroke, mean MMSE\textsuperscript{23} and AASP\textsuperscript{26} values, mean Beck Depression Scale\textsuperscript{24} scores, or the frequency of patients with DSM-III-R dementia.\textsuperscript{17} However, the patients who were not examined were more often dependent in daily life (51.7% versus 35.0%, P = 0.0002), were more severely physically handicapped as measured on the Barthel Index\textsuperscript{25} (mean ± SD 16.6 ± 5.3 versus 18.3 ± 3.6, P &lt; 0.0001), and had more severe stroke measured on the SSS\textsuperscript{19} (50.2 ± 11.5 versus 53.9 ± 8.6, P &lt; 0.0001).

Most of the patients (221 of the sample of 277; 80%) were examined at the psychiatrist’s own place of work; 29 patients were seen in the hospital, 21 in the patient’s home, and 6 in nursing homes. The clinical psychiatric examinations were conducted using the SCAN protocol.\textsuperscript{16} The majority of patients (n = 222) were examined by a senior psychiatrist (A.L.) who had attended a WHO-designated SCAN training course. The senior psychiatrist also afterward supervised the data entry concerning patients examined by the resident psychiatrist (I.S., n = 55). The main content of SCAN is the 10th version of the Present State Examination (PSE\textsuperscript{10}). The PSE-10 procedure covers a wide range of affective and other psychotic symptoms, signs, and behavior; its earlier version (PSE-9) has been widely used in research concerning elderly and physically ill patients.

The data from interviews (lasting from 1 to 2 hours) was put directly into a portable computer. The Gatego-5 computer program of SCAN first computes a total symptom score and derives syndromes from combinations of the rated symptoms; it then computes a measure of the severity of any psychopathology present, and finally it constructs a prediagnosis profile for the ICD-10\textsuperscript{12} and DSM-III-R\textsuperscript{13} categories.

The severity of depression was assessed using the Montgomery-Asberg Rating Scale (MADRS\textsuperscript{14}). A cutoff point of 6 or higher was applied to distinguish the patients with a depressive symptomatology in the clinical range from those with less severe symptoms. The reliability and validity of this scale have been demonstrated compared with other observer-rated scales.\textsuperscript{40} It emphasizes the psychological symptoms of depression, reducing the risk that depression-mimicking somatic symptoms may be erroneously interpreted as depression.

The patients completed the 21-item Beck Depression Inventory (BDI), the 20-item Zung’s Self-Rating Depression Scale (SDS\textsuperscript{15}), the 20-item Zung’s Self-Rating Anxiety Scale (SAS\textsuperscript{16}), and the Derogatis’ Symptom Check List (SCL-90-R\textsuperscript{17}). Whenever possible, the close informants of subjects were interviewed briefly in conjunction with the psychiatric evaluation. A Neuropsychiatric Inventory (University of California at Los Angeles\textsuperscript{18}) was completed, assessing the frequency and severity of 10 neuropsychiatric symptoms or signs.

The diagnoses of depressive disorders 3 to 4 months after stroke were made on the basis of the DSM-III-R\textsuperscript{19} and ICD-10\textsuperscript{12} diagnostic criteria. The DSM-III criteria have been shown to be appropriate for the identification of depression in older patients19,41,44 in several studies, even for patients with acute stroke.\textsuperscript{41,46} Patients with DSM-III-R major depressive disorder (single or recurrent episode), bipolar disorder (depressed episodes), organic mood disorder (organic depressive disorder), or dementia with depressed mood (DSM-IV) were grouped as having “major depression.” Patients with adjustment disorder (depressed or mixed anxiety and depressed mood), dysthymic disorder, or major depressive disorder in partial remission were grouped as having “minor depression.” The patients with “major depression” and no other recent psychosocial stress factor except stroke were defined as having pure “stroke-related major depression.” The grouping of poststroke depressive disorders into major and minor depression subgroups has been used in most earlier studies.\textsuperscript{47,48} We used it here to compare our results with those of other studies.

The study was approved by the ethics committee of the Department of Neurology, University of Helsinki. It was first fully explained to the patients, and if they agreed to participate, a written consent form was signed.

We compared the patients who did have depressive disorders to those who did not. The χ\textsuperscript{2} test was applied for categorical data and the pooled t test for continuous data. All the variables that significantly differentiated the 2 groups were put into a logistic regression model to work out the independent correlates of depression. The statistics were analyzed using the BMDP and SAS programs.\textsuperscript{49,50}
Some depressive disorder was diagnosed in 111 of 277 patients (40.1%) according to both DSM-III-R and ICD-10 criteria: DSM-III-R major depression in 72 (26.0%), minor depression in 39 (14.1%), and pure stroke-related major depression in 49 (17.7%) patients (Figure). The Beck self-rating questionnaire (completed by 260 patients) identified depression in 98 or 48 patients (37.7% or 18.5%) when the cutoff point for depression was defined as being ≥10 or ≥14, respectively.

On the basis of DSM-III-R and ICD-10 definitions, major depression was diagnosed in 72 and 78 patients (26.0% and 28.2%), and minor depression in 39 and 33 patients (14.1% and 11.9%), respectively. All the patients who were diagnosed as having major depression according to the DSM-III-R definition also fulfilled the ICD-10 criteria. There were 49 patients (17.7%) who fulfilled the DSM-III-R criteria for dementia. Of these 49 demented patients, 30.6% (15 versus 34, \( P = 0.4164 \)) had major depression according to DSM-III-R criteria, 36.7% (18 versus 31, \( P = 0.5991 \)) had some depression, and 10.2% (5 versus 44, \( P = 0.08764 \)) had stroke-related depression. Comparing the depressed and nondepressed patients, there was no statistically significant difference with regard to sex, age, education, stroke type, stroke localization, stroke syndrome, history of previous CVD, AASP, or MMSE according to any definition. The statistics of stroke type and localizations in patients with and without any depression (major or minor) are shown in Table 1. There were no significant differences in these stroke characteristics in patients either with or without major depression or stroke-related depression.

The patients with depression were more severely physically handicapped (Barthel Index), had more physically disabling stroke (SSS), and were more often dependent (Table 2). Patients with some depression (26.1% versus 13.9%, \( P = 0.0104 \)) and DSM-III-R major depression (29.2% versus 15.1%, \( P = 0.0087 \)) more frequently had a history of prestroke depression compared with the nondepressed patients (Table 2). On the other hand, the patients with stroke-related major depression less often had a history of prestroke depression compared with the rest of the patients (8.2% versus 21.2%, \( P = 0.0351 \)) (Table 2). Of the patients with PSD, 38.7% (43 of 111) had received antidepressant treatment.

The variables that significantly differentiated the patients with and without depression were put into a multiple logistic regression model (Table 3). Depression was related to dependence (odds ratio [OR], 1.8; 95% confidence interval [CI], 1.1 to 3.1) and to a history of prestroke depression (OR, 2.3; 95% CI, 1.3 to 4.4). DSM-III-R major depression was also related to dependence (OR, 2.9; 95% CI, 1.6 to 5.5) and to prestroke depression history (OR, 3.4; 95% CI, 1.7 to 6.7). However stroke-related major depression correlated only with stroke disability as measured on the SSS (OR, 1.1; 95% CI, 1.0 to 1.1).

### Results

Some depressive disorder was diagnosed in 111 of 277 patients (40.1%) according to both DSM-III-R and ICD-10 criteria: DSM-III-R major depression in 72 (26.0%), minor depression in 39 (14.1%), and pure stroke-related major depression in 49 (17.7%) patients (Figure). The Beck self-rating questionnaire (completed by 260 patients) identified depression in 98 or 48 patients (37.7% or 18.5%) when the cutoff point for depression was defined as being ≥10 or ≥14, respectively.

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### Discussion

Our objective was to achieve a more precise and versatile evaluation of PSD. We therefore used various psychometric...
rating scales, a standardized clinical psychiatric interview (PSE-10), and the DSM-III-R and ICD-10 diagnostic criteria. Clinically significant depression was found to be common 3 to 4 months after stroke, affecting 40% (111 of 277) of the patients according to the DSM-III-R criteria for depression. Major depression was found in 26% and minor depression in 14% of the patients. The total frequency of depressive disorders as defined by the ICD-10 criteria was the same, and the rate of major depression was slightly higher (28.2%) than the corresponding values based on the DSM-III-R criteria. In studies of nonstroke patients, it has been shown that the frequencies obtained for depressive and bipolar disorders do not differ substantially between DSM-III-R and ICD-10 systems.

In the previous studies based on self-report inventories, depressive symptoms were found in 20% to 50% of patients, from weeks to 1 year after stroke. In a previous study in Finland, it was shown using a population-based register that the frequency of depressive patients at 3 months from stroke onset was 44% (BDI cutoff point, ≥14). In a recent large unselected stroke population, the corresponding figure was almost 50% (BDI cutoff point, ≥10).

In 1983 and 1984, Robinson et al found that the rate of depression during the first 6 months of follow-up varied from 40% to 60%. This study was conducted using selected in-hospital population and modified rating scales. Robinson et al subsequently showed that the DSM-III criteria could be used to diagnose poststroke major depression without significant overdiagnosis or underdiagnosis.

In later studies, depression defined using DSM-III criteria was found to vary from 30% to 50%, major depression from 13% to 31%, and minor depression from 20% to 50%

### Table 2. Characteristics of Patients With Ischemic Stroke Classified According to Different Definitions of Depression in the SAM Cohort (n=277)

<table>
<thead>
<tr>
<th>Definition for Depression</th>
<th>No. of Patients</th>
<th>Barthel Index, Mean±SD</th>
<th>SSS, Mean±SD</th>
<th>Dependence, No. of Patients</th>
<th>History of Prestroke Depression, No. of Patients</th>
<th>MMSE, Mean±SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any depression Present</td>
<td>111 (40.1)</td>
<td>17.8±3.8</td>
<td>52.0±10.6</td>
<td>49 (44.1)</td>
<td>29 (26.1)</td>
<td>25.8±3.5</td>
</tr>
<tr>
<td>Absent</td>
<td>166 (59.9)</td>
<td>18.7±3.5</td>
<td>55.2±6.8</td>
<td>48 (28.9)</td>
<td>23 (13.9)</td>
<td>25.7±4.4</td>
</tr>
<tr>
<td>P=0.0381</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P=0.0031</td>
<td></td>
</tr>
<tr>
<td>DSM-III-R major depression Present</td>
<td>72 (26.0)</td>
<td>17.3±4.2</td>
<td>51.2±11.5</td>
<td>37 (51.4)</td>
<td>21 (29.2)</td>
<td>25.3±3.8</td>
</tr>
<tr>
<td>Absent</td>
<td>205 (74)</td>
<td>18.7±3.3</td>
<td>54.9±7.2</td>
<td>60 (29.3)</td>
<td>31 (15.1)</td>
<td>25.9±4.2</td>
</tr>
<tr>
<td>P=0.0040</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P=0.0007</td>
<td></td>
</tr>
<tr>
<td>Pure stroke-related major depression Present</td>
<td>49 (17.7)</td>
<td>16.5±4.7</td>
<td>48.7±13.2</td>
<td>28 (57.1)</td>
<td>4 (8.2)</td>
<td>25.8±3.4</td>
</tr>
<tr>
<td>Absent</td>
<td>228 (82.3)</td>
<td>18.7±3.2</td>
<td>51.1±6.7</td>
<td>68 (30.0)</td>
<td>48 (21.2)</td>
<td>25.7±4.2</td>
</tr>
<tr>
<td>P&lt;0.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P=0.0035</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Correlates of Depression 3 Months After Ischemic Stroke Using Multiple Logistic Models in the SAM Cohort

<table>
<thead>
<tr>
<th>Definition for depression</th>
<th>B</th>
<th>SE</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any depression Dependence</td>
<td>0.5838</td>
<td>0.2712</td>
<td>1.793</td>
<td>1.054–3.058</td>
</tr>
<tr>
<td>History of prestroke depression</td>
<td>0.8506</td>
<td>0.3247</td>
<td>2.341</td>
<td>1.267–4.370</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.2671</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM-III-R major depression Dependence</td>
<td>1.0653</td>
<td>0.3203</td>
<td>2.902</td>
<td>1.556–5.486</td>
</tr>
<tr>
<td>History of prestroke depression</td>
<td>0.7831</td>
<td>0.3383</td>
<td>3.356</td>
<td>1.659–6.749</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.5218</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke-related major depression Stroke severity measured on SSS</td>
<td>0.0778</td>
<td>0.0257</td>
<td>1.1</td>
<td>1.025–1.137</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.2018</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
hemispheric lesions. However, this was not the case in the present study.

The depressed patients were more dependent in ADL functions, as measured by the Barthel Index, and were more severely handicapped, as measured on the SSS. According to multiple logistic regression analysis, dependence correlated with all depression and with DSM-III-R major depression; the severity of stroke, as estimated on the SSS, was the only weak correlate of stroke-related major depression. It also has been shown previously that depressive patients need more help in ADL and are more often in institutional care.

A history of previous depression was more common among depressed patients and correlated to any depression and to major DSM-III-R depression, according to the logistic regression analysis. A prestroke history of depression has been found to be significant in some studies but not in others.

Numerous emotional and behavioral disorders occur after cerebrovascular lesions. Depression is the most common of these, affecting up to 40% of patients (in the present study, 40.1%). Among similarly aged individuals in the community, the prevalence of depression has been estimated to be 15% and that of major depression 0.1% to 3.7%. We therefore agree with earlier studies that irrespective of the diagnostic methods of ascertaining depression, it is clearly underdiagnosed in clinical practice. Furthermore, the rate of psychiatric consultation in the case of stroke patients has been low (6.3%).

Only 39% of patients with any depression in the present study were using antidepressive drugs at the time of psychiatric examination. This is the same level (39%) as reported by Morris et al; however, it is much more than found in an unselected Finnish stroke population, in which only 17% of depressive patients were receiving antidepressive treatment.

In conclusion, depressive patients were more often dependent and more often had a prestroke history of depression. They could have been more disabled because of retarded rehabilitation. There seemed to be a high percentage (17.7%) of major depression after stroke, for which no other explanatory factor besides stroke could be found. Altogether, 62 patients (22.4%) had minor or major depression along with other explanatory factors, the most significant of which was prestroke depression. We emphasize the importance of a thorough psychiatric evaluation of poststroke patients, particularly those who have a severe disability and a history of previous depressive episodes.

Acknowledgments

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References


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The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/29/11/2311