Frequency and Clinical Determinants of Poststroke Depression

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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,[8] 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).[4,9–13] However, PSD is most likely not solely a psychological reflection of a physical disability. Folstein et al[14] 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,[1,4,5,9] although this has also been denied.[1,15]

The aim of the present study was to evaluate the frequency and clinical correlates of PSD in an 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-*

Received July 10, 1998; final revision received August 25, 1998; accepted August 25, 1998.

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cation of Diseases, 10th Revision (ICD-10)[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.[19,20] 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.).[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,[21] and the National Stroke Data Bank (United States).[22]

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

The history of main vascular risk factors was completed for each patient.[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.[27] The localization of the stroke was divided into right hemispheric, left hemispheric, and bilateral, as well as into anterior (carotid), posterior (vertebrobasilar), and anteroposterior circulation.[28–34] The stroke syndromes assessed included major dominant and nondominant hemispheric, minor dominant and nondominant hemispheric, deep/lacunar, brain stem and cerebellar, and unknown.[22] Stroke severity was assessed using the Scandinavian Stroke Scale (SSS).[35]

We applied the clinical criteria for dementia as presented by the DSM-III-R.[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 >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.[36]

Clinical neurological and mental status examinations were conducted for 451 patients.[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, $P<0.001$) and of more severe stroke as measured on the SSS[35] (31.3 versus 54.0, $P<0.001$), 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[37] 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 evaluation 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[23] and AASP[26] values, mean Beck Depression Scale[24] scores, or the frequency of patients with DSM-III-R dementia.[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[25] (mean±SD 16.6±5.3 versus 18.3±3.6, $P<0.0001$), and had more severe stroke measured on the SSS[35] (50.2±11.5 versus 53.9±8.6, $P<0.0001$).

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.[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-10[38]). The PSE-10 procedure covers a wide range of affective and other psychiatric 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[18] and DSM-III-R[17] categories.

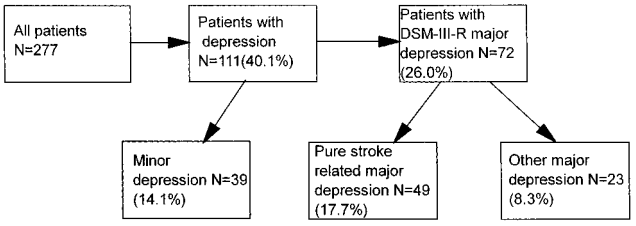
The severity of depression was assessed using the Montgomery-Åsberg Rating Scale (MÅDRS[39]). A cutoff point of 6 or higher was applied to distinguish the patients with a depressive symptomatology in the clinical range from those with less severe symptoms. The reliability and validity of this scale have been demonstrated compared with other observer-rated scales.[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[41]), the 20-item Zung's Self-Rating Anxiety Scale (SAS[42]), and the Derogatis' Symptom Check List (SCL-90-R[43]). 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[44]) 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[17] and ICD-10[18] diagnostic criteria. The DSM-III criteria have been shown to be appropriate for the identification of depressive disorders in several studies, even for patients with acute stroke.[45,46] 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.[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^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.[49,50]



The distribution of patients into various depression classes in the SAM study.

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.

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 to 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).

Discussion

Our objective was to achieve a more precise and versatile evaluation of PSD. We therefore used various psychometric

TABLE 1. Type and Localization of Stroke in Patients With and Without Depression (Major or Minor) in the Helsinki Stroke Aging Memory Study Cohort (n=277)

	Nondepressed (n=166)	Depressed (n=111)	All (n=277)	*P*
Stroke type				
Large artery	30 (18.1)	30 (27.0)	60 (21.7)	0.0762
Cardioembolism	24 (14.5)	10 (9.0)	34 (12.3)	0.1756
Small-vessel occlusion (lacunar)	11 (6.6)	7 (6.3)	18 (6.5)	0.9156
Unknown	101 (57.7)	64 (60.8)	165 (59.6)	0.5965
Stroke localization				
Right hemisphere	76 (45.8)	43 (38.7)	119 (43.0)	0.2458
Left hemisphere	86 (58.6)	65 (51.8)	151 (54.5)	0.2688
Bilateral	4 (2.7)	3 (2.4)	7 (2.5)	0.8790
Anterior circulation	123 (76.6)	85 (74.1)	208 (75.1)	0.6400
Posterior circulation	41 (24.7)	25 (22.5)	66 (23.8)	0.6769
Anteroposterior circulation	0 (0.0)	3 (1.5)	3 (1.1)	0.8107
Right hemisphere and anterior	53 (31.9)	29 (26.1)	82 (29.6)	0.3000
Left hemisphere and anterior	70 (42.2)	56 (50.5)	126 (45.5)	0.1750
Right hemisphere and posterior	23 (13.9)	14 (12.6)	37 (13.4)	0.7657
Left hemisphere and posterior	15 (9.0)	9 (8.1)	24 (8.7)	0.7879

Values are number (%).

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

Definition for Depression	No. of Patients (%)	Barthel Index, Mean±SD	SSS, Mean±SD	Dependence, No. of Patients (%)	History of Prestroke Depression, No. of Patients (%)	MMSE Mean±SD
Any depresstion						
Present	111 (40.1)	17.8±3.8	52.0±10.6	49 (44.1)	29 (26.1)	25.8±3.5
Absent	166 (59.9)	18.7±3.5	55.2±6.8	48 (28.9)	23 (13.9)	25.7±4.4
		P=0.0381	*P*=0.0031	*P*=0.0092	*P*=0.0104	*P*=0.7531
DSM-III-R major depression						
Present	72 (26.0)	17.3±4.2	51.2±11.5	37 (51.4)	21 (29.2)	25.3±3.8
Absent	205 (74)	18.7±3.3	54.9±7.2	60 (29.3)	31 (15.1)	25.9±4.2
		P=0.0040	*P*=0.0015	*P*=0.0007	*P*=0.0087	*P*=0.3249
Pure stroke-related major depression						
Present	49 (17.7)	16.5±4.7	48.7±13.2	28 (57.1)	4 (8.2)	25.8±3.4
Absent	228 (82.3)	18.7±3.2	51.1±6.7	68 (30.0)	48 (21.2)	25.7±4.2
		P<0.0000	*P*<0.0000	*P*=0.0003	*P*=0.0351	*P*=0.9634

rating scales, a standardized clinical psychiatric interview (PSE-10),[38] and the DSM-III-R and ICD-10 diagnostic criteria.[17,18]

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[17] 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[18] 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.[17] 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.[51]

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.[15,52–55] 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).[52] In a recent large unselected stroke population, the corresponding figure was almost 50% (BDI cutoff point, ≥10).[53]

The corresponding BDI values in the present study were 19% and 38%. Our BDI figures are comparable with those of the study of House et al,[56] who found the prevalence of depression at 6 months after stroke to be 15% when using a BDI cutoff point of ≥13 and 32% when using a cutoff point of ≥10 for depression.

In 1983 and 1984, Robinson et al[57,58] 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[45,46] 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

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

Definition for depression	B	SE	OR	95% CI
Any depression				
Dependence	0.5838	0.2712	1.793	1.054–3.058
History of prestroke depression	0.8506	0.3247	2.341	1.267–4.370
Constant	−2.2671			
DSM-III-R major depression				
Dependence	1.0653	0.3203	2.902	1.556–5.486
History of prestroke depression	0.7831	0.3383	3.356	1.659–6.749
Constant	−0.5218			
Stroke-related major depression				
Stroke severity measured on SSS	0.0778	0.0257	1.1	1.025–1.137
Constant	−3.2018			

40%.[4,58–60] Morris et al[61] analyzed a sample of 99 patients at 2 months after stroke and diagnosed 18% and 14% as having minor and major depression, respectively. Åström et al[4] found that the frequency of major depression in a population-based cohort of 80 patients with stroke was 25% at the acute stage and 31% at 3 months after stroke. Burvill et al[62] reported that in a community-based study 4 months after stroke, the prevalence of depressive illness was 23% (15% major depression and 8% minor depression).

The only previous study to use a methodology similar to ours has been that of House et al.[56] They reported that using an earlier version of PSE and DSM-III, the prevalence of major depression was 9% at 6 months after stroke. This is much lower than the percentage in the present study. The inclusion of organic mood disorder (5 patients) and dementia with depressed mood (13 patients) in the major depression group might explain the relatively high prevalence of major depression in our findings. As in the present study, the patients with minor depression fulfilled the diagnostic criteria of adjustment disorder (depressed or mixed anxious and depressed).[56] In most other studies, minor depression was defined as DSM-III dysthymic disorder, without the 2-year symptom duration criteria.

The fourth version of the DSM[63] categorizes PSD as "the mood disorder due to general medical condition (ie, stroke)" with 1 of the following subtypes: (1) depressive features, (2) major depressive-like episode, and (3) mixed (depression, mania) features. This classification requires that mood disorder is the direct physiological consequence of a general medical condition. This means a new starting point in the future classification of PSD.

It has been reported earlier that patients having ischemic stroke in the left hemisphere are more depressive than those having it in the right hemisphere.[5,9] This is a controversial argument, and many studies disagree.[10,15,52,53,64–66] This study showed no significant correlation between depression and stroke localization. Åström et al[4] found that a left-sided hemispheric lesion was the most important predictor of immediate depression. When the lesion was located in the left anterior hemisphere, the rate of major depression was 3 times higher compared with a left posterior lesion, and as much as 10 times higher compared with a lesion in the right hemisphere. However, after 3 months, these intrahemispheric and interhemispheric differences were no longer significant. The latter finding is consistent with the results of this study at 3 months after stroke.

There was no significant difference between depressed and nondepressed patients in stroke type and stroke syndrome, history of previous cerebrovascular disease, age, sex, education, living condition (alone or with someone else), aphasia estimated by AASP battery, MMSE, or frequency of DSM-III-R dementia. Younger age has been found to be associated with depression.[57] Living alone has been associated with depression in some studies[4] but not in others.[5,65] Cognitive impairment has been found to be associated with major depression in patients with left hemispheric lesions.[61] 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.[4,11,13,53]

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[67] but not in others.[4]

Numerous emotional and behavioral disorders occur after cerebrovascular lesions. Depression is the most common of these, affecting up to 40% of patients[47] (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%.[68] We therefore agree with earlier studies[5,9,53] that irrespective of the diagnostic methods of ascertaining depression, it is clearly underdiagnosed in clinical practice.[8] Furthermore, the rate of psychiatric consultation in the case of stroke patients has been low (6.3%).[69]

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[61]; however, it is much more than found in an unselected Finnish stroke population, in which only 17% of depressive patients were receiving antidepressive treatment.[53]

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.[13] 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

This work was supported by grants from the Medical Council of the Academy of Finland, Helsinki; the Clinical Research Institute, Helsinki University Central Hospital, Helsinki; and the Finnish Alzheimer Foundation for Research, Helsinki. We thank senior research officer Vesa Kuusela, Statistics Finland, Helsinki, for the statistical support and review. We also thank Megan Burton, BA, for linguistic assistance with the manuscript.

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Stroke. 1998;29:2311-2317
doi: 10.1161/01.STR.29.11.2311
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0039-2499. Online ISSN: 1524-4628